Agriculture, Food & Natural Resources

Career Cluster Resources for Agriculture, Food and Natural Resources

www.careerclusters.org

Table of Contents

Introduction

The States' Career Cluster Initiative

9/01/02

Charles Losh, Ph.D., Project Director

The U.S. Department of Education Office of Vocational and Adult Education (OVAE) has identified 16 career clusters representing career opportunities for the 21st century economy. These clusters will frame student opportunities as they pursue postsecondary education and a wide range of career opportunities from front-line to professional and managerial careers.

Helping students make their dreams become a reality was the driving force behind the nation's Career Clusters initiative launched June 1, 2001. Twelve lead states and the District of Columbia were partners in the development of the tools supporting eleven career clusters which, when combined with the five clusters that have already been developed, will represent all career possibilities.

The National Association of State Directors for Career and Technical Education Consortium (NASDCTEc) and their Board of Directors assumed leadership for coordinating the project. This in itself was unique for a project of this scope. The Board and the State Directors organization believed that this initiative was of such potential impact on the Career Technical delivery system in the country that they needed to play this leadership role in the project, assuring that the materials had utility in their states once completed. Therefore, the NASDCTEc in conjunction with the State of Oklahoma (the project fiscal agent) prepared and submitted a proposal to OVAE in January of 2001. This proposal was funded at a $2.2 million dollar level, with expectations of a second year of funding of $2.5 million. The plan to develop eleven curriculum frameworks was very aggressive, given that each of the prior projects, designed to develop and pilot test materials for a single cluster, had received in excess of $1 million dollars for their multiyear development work.

The project was designed to establish curriculum frameworks and supportive materials for each cluster, with a broad-based advisory committee for each cluster, led by a state. There was also a National Advisory Committee consisting of members from each of the cluster committees, along with other stakeholders. The National and State Cluster advisory committees were responsible for identifying the frameworks, pathway and foundation knowledge and skills, and other supportive

materials. The committees included representatives from states, schools, education and training, business and industry, associations, and others directly impacted by the materials.

The development of materials for each of the eleven clusters was led by a different state, with business and industry at the helm. The lead states included: Idaho and Iowa (jointly leading the Agriculture, Food and Natural Resources cluster), Pennsylvania (Architecture and Construction), Ohio (Marketing, Sales and Service), North Dakota (Finance), West Virginia (Hospitality and Tourism), South Carolina (Business, Management and Administration), Kentucky (Human Services), Arkansas (Law, Public Safety and Security), North Carolina (Science, Technology, Engineering and Mathematics), Michigan (Education and Training), and Oklahoma and the District of Columbia/Washington D.C. (jointly leading the Government and Public Administration cluster).

The five additional career clusters included Health Science led by the State of Utah, Manufacturing led by the State of Indiana, Arts, Audio Video Technology and Communications led by the V-TECS Consortium, Information Technology led by the Educational Development Center, Inc., and Transportation, Distribution and Logistics Cluster led by the State of Illinois. These clusters plan to complete their work by June 30 of 2003.

To facilitate and coordinate the developmental work of the Cluster Initiative, staff was identified and housed at the Oklahoma Department of Career and Technical Education. The staff consisted of four Cluster Coordinators: Marsha Daves, Greg Dewald, Curtis Shumaker, and Pam Stacey. Additionally, Denise Christy provided research and web development support, Lisa Batchelder provided financial support, and Karan Smith provided administrative support.

Development work for the States' Career Clusters Initiative began June 1, 2001, and the first meeting of lead states, OVAE staff, and cluster staff was held in Oklahoma City in mid-June. At this meeting, project objectives, general direction, timelines, and the initial research goals were identified. This work continued through the fall and winter of 2001 and included the identification of cluster advisory committee members, the development of cluster frameworks based on the prototype cluster models provided by V-TECS, and the identification of occupations and draft pathways along with degrees and certificates associated with the career specialties/occupations in each of the clusters.

In January of 2002, the lead state teams were brought together in Phoenix to begin the process of developing knowledge and skill statements for each of the cluster pathways and foundations. Contracted writers and lead state cluster advisory committee members, depending upon

the decisions of cluster leadership, carried out this work. A part-time editor in Oklahoma provided consistency across the cluster knowledge and skill statements. One concern that was addressed early in the process was the need for a "common look and feel" across the clusters. Ultimately, this was accomplished not only for the eleven clusters in the States' Career Clusters Initiative, but also through close cooperative relationships between the projects, all the cluster knowledge and skill statements were developed (or retro-fitted) using the same format. This format includes a knowledge/skill statement with associated performance elements and measurement criteria. This format provides the tools needed for curriculum and assessment developers as they take the materials to the classroom.

The National Advisory Committee met in March of 2002, and reviewed the curriculum frameworks, credentials list, and lead state advisory committee memberships and structures, and forwarded those materials to the Executive Committee for the Project. The Executive Committee, made up of the Board of the NASDCTEc, also met in March, approved the materials and discussed the future actions needed to assure implementation of the cluster materials.

Originally, the project was designed for a minimum of two years and was to include the identification of 110 pilot test sites across the country, along with the development of assessments and certifications for the clusters. The Office of Vocational and Adult Education, however, determined in November of 2001 that the goals of the project were "too broad", and terminated the project as of September 30, 2002.

Development of the products needed for curriculum and assessment was fast-tracked, with the knowledge and skill statements, performance elements and measurement criteria ready for validation by July 15, 2002. This was the result of a major effort of lead state advisory committees and staff responding to the shortened timeline and the need for quality product.

Given the efforts of the developmental teams, cluster advisory committee members were able to review and validate the knowledge and skills and supporting elements. Additionally, a national web-based validation was conducted from July 15 to August 15, 2002. All 50 states were invited to a dissemination meeting held in Charleston, South Carolina Sept 13, 2002, where the materials were distributed to participants for their use in updating their curriculum.

For further information on the status of the materials, go to the web-site, http://www.careerclusters.org/.

Section I – Pathway Model

The production, processing, marketing, distribution, financing, and development of agricultural commodities and resources including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

Sample Career Specialties / Occupations	Agricultural Sales ● Agricultural Communications Specialists ● Business-Educators ● Food Scientists ● Meat Processors-Toxicologists ● Biochemists-Nutritionists-Dieticians ● Food Brokers-Food Inspectors ● Meat Cutters-Meat Graders ● Meat Science Researchers ● Food Meal Supervisors ● Cheese Makers ● Microbiologists ● Produce Buyers ● Bacteriologists ● Food & Drug Inspectors ● Bioengineers ● Biochemists ● Food & Fiber Engineers ● Food Processors ● Storage Supervisors● Fieldman ● Quality Control Specialists	Bioinformatics Specialists ● Plant Breeders and Geneticists ● Biotechnology Lab Technician ● Soil & Water Specialists ● Crop Farm Managers ● Agricultural Educators ● Plant Pathologists ● Aquaculturalists ● Sales Representatives ● Botanists ● Tree Surgeons ● Education & Extension Specialists ● Agricultural Journalists ● Commodity Marketing Specialists ●Grain Operations Superintendents ●Custom Hay/Silage Operators ● Forest Geneticists ● Golf Course Superintendents ● Greenhouse Mangers ● Growers ● Farmers ●Ranchers	Agricultural Educators ● Livestock producers ● AI Technicians-Aquaculturalists ● Animal Caretakers-Poultry Managers ● Equine Managers-Veterinarians ● Veterinary Assistants-Feedlot Specialists ● Animal Scientists ●Embryo Technologists ● Livestock Buyers ● Feed Sales Representatives ● Vivarian Technicians ● Wildlife Biologists ● Livestock Geneticists ● Animal Nutritionists ● Dairy Producers● Livestock Inspectors ● Feed Sales Specialists ●Animal Health Salespersons ●Meat Science Researcher ●Reproductive Physiologists ● Embryo Transfer Technicians ● Pet Shop Operators ●USDA Inspectors	Machine Operators ● Electronics Systems Technicians ● Agricultural Engineers ● Agricultural Extension Engineering Specialists ● Heavy Equipment Maintenance Technicians ● Recycling Technicians ● Waste Water Treatment Plant Operators ● Equipment/Parts Mangers ● Welders ● Machinists ● Communication Technicians ● Agricultural Applications Software Developers/Programmers ● Database Administrators ● Computer Service Technical Support Technicians ● Information Lab Specialists ●GPS Technicians● Remote Sensing Specialists	Cartographers ● Wildlife Managers ● Range Technicians ● Ecologists Park Mangers ● Environmental Interpreters ● Fish and Game Officers Loggers ● Forest Technicians ● Log Graders ● Pulp and Paper Manager Soil Geology Technician ● Geologists ● Mining Engineers Fisheries Technicians ● Water Monitoring Technician ● Hydrologists ● Fish Hatchery Manager Commercial Fishermen ● Fishing Vessel Operators ● Vessel Crew	Pollution Prevention and Control Managers ● Pollution Prevention and Control Technicians● Environmental Sampling and Analysis Scientists/Technicians● Health and Safety Sanitarians● Environmental Compliance Assurance Managers● Hazardous Materials Handlers ● Hazardous Materials Technicians / Managers● Water Environment Managers ● Water Quality Managers● Waste Water Managers● Toxicologists● Solid Waste Disposers / Recyclers● Solid Waste Technician● Solid Waste Managers ● Solid Waste Specialists	Salesperson ● Sales Manager ●Banker/Loan Officer ● Field Representative for Bank, Insurance Company or Government Program ● Farm Investment Manager ● Agricultural Commodity Broker ● Agricultural Economist ● Farmer /Rancher/Feedlot Operator ● Farm Manager ● Livestock Rancher / Breeder ● Dairy Herd Supervisor (DHIA) ● Agricultural Products Buyer ● Animal Health Products Distributor ● Livestock Seller ● Feed and Supply Store Manager ● Produce Commission Agent ● Ag Lenders ● Agricultural Chemical Dealer ● Field Service Representative ● Chemical Sales Representative
Pathways	**Food Products and Processing Systems** (Food Processing and preserving, Packaging, Distribution, Government monitoring & regulation)	**Plant Systems** (Agronomic, Horticulture, Forestry, Turf, Viticulture, Soils, etc.)	**Animal Systems** (Large animals, small animals, wildlife animals, and research animals)	**Power, Structural & Technical Systems** (Power, Structures, Controls, Geospatial Technology, Computer Systems, Electronics, Hydraulics, Pneumatics, etc.)	**Natural Resources Systems** (Habitat Conservation, Forest Products, Parks and Recreation, Mining, Environmental Services, Fisheries, Soil Conservation, etc.)	**Environmental Service Systems** (Pollution Prevention, Water & Air Quality, Hazardous Materials, Solid Waste Management, Health & Safety Sanitation, etc.)	**Agribusiness Systems** (Sales, Service, Farm and Ranch Management, Entrepreneurship, Economics, etc.)
Cluster K&S	**Cluster knowledge and skills** ♦Academic Foundations ♦Communications ♦Problem Solving and Critical Thinking ♦Information Technology ♦ Systems ♦ Safety, Health and Environment ♦Leadership and Teamwork ♦Ethics and Legal Responsibilities ♦Employability and Career Development ♦Technical Skills						

Section II – Cluster Knowledge and Skills

Cluster Knowledge and Skill Statement

Academic Foundations

Statement: Achieve specific academic knowledge and skills required to pursue the full range of career and post-secondary education opportunities within AFNR.

Performance Element: Pass certification tests to meet state academic standards and qualify for selected fields of study.

- ***Measurement Criteria:*** *Achieve an acceptable score on the State tests.*
- ***Measurement Criteria:*** *Explain what types of skills or knowledge are necessary to work in a specific field of study.*
- ***Measurement Criteria:*** *Know what type of degree or certification is required to enter a desired job/career.*

Performance Element: Be proficient in using a variety of resources for both research and development.

- ***Measurement Criteria:*** *Conduct informational searches.*
- ***Measurement Criteria:*** *Define what types of resources are appropriate for locating scholarly and academic information.*
- ***Measurement Criteria:*** *Analyze materials to determine their value for research and development areas.*

Cluster Knowledge and Skill Statement

Communications

Statement: Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information within AFNR.

Performance Element: Develop good reading skills to enable reading of technical materials with understanding and fluency.

- ***Measurement Criteria:*** *Comprehend a broad range of reading materials containing technical concepts, knowledge and vocabulary to better handle written and electronic information.*
- ***Measurement Criteria:*** *Use reading strategies (e.g., word analysis) to expand understanding and fluency.*
- ***Measurement Criteria:*** *Locate, organize and reference written information from various sources (books, journals, magazines, Internet) to answer questions, solve problems, and develop written and oral communication.*

Performance Element: Compose written material to present technical information.

- ***Measurement Criteria:*** *Compose multi-paragraph writing containing technical concepts, knowledge and vocabulary to complete an effective document.*
- ***Measurement Criteria:*** *Develop and incorporate tables, charts, graphs and figures to support written and oral communications.*
- ***Measurement Criteria:*** *Use information technology to design, produce and present written and multimedia materials.*

Performance Element: Listen effectively to learn in both formal and informal situations.

- ***Measurement Criteria:*** *Appreciate personality preferences to achieve full meaning in processing and sharing information.*
- ***Measurement Criteria:*** *Recognize the meanings of posturing to interpret nonverbal communications and messages.*
- ***Measurement Criteria:*** *Apply active listening skills to obtain information and clarify oral communications.*

Performance Element: Develop speaking skills to present information orally in formal and informal situations.

- ***Measurement Criteria:*** *Access a broad range of technical concepts, knowledge and vocabulary to develop and deliver formal presentations and to use in informal discussions.*
- ***Measurement Criteria:*** *Apply human relations skills to contribute effectively to group discussions and meetings.*

Performance Element: Write clearly to communicate written ideas, results and questions to all types of people.

- ***Measurement Criteria:*** *Write with effective language to produce written communications for journals, newsletters, or other informative articles.*
- ***Measurement Criteria:*** *Explain aspects of the industry to people not involved in it, and discuss its components.*

Cluster Knowledge and Skill Statement

Performance Element: Know how to orally communicate clearly and effectively to have dialogue with members of an example career field.

Measurement Criteria: *Monitor different kinds of behavior in order to improve communication.*

Measurement Criteria: *Prepare presentations to explain to both large groups and individuals issues of concern to the industry.*

Measurement Criteria: *Discuss aspects of the industry competently to an audience of both professionals and people not involved in the industry.*

Statement: Employ technical communications effectively to maintain good records and reporting procedures.

Performance Element: Use technical communications to document work and processes.

Measurement Criteria: *Record technical information.*

Measurement Criteria: *Compose technical reports.*

Measurement Criteria: *Communicate documentation to others.*

Cluster Knowledge and Skill Statement

Problem Solving and Critical Thinking

Statement: Solve problems using critical thinking skills (e.g., analyze, synthesize and evaluate) independently and in teams.

Performance Element: Formulate and evaluate ideas, proposals and solutions to handle problems.

Measurement Criteria: *Formulate ideas and proposals to solve problems.*

Measurement Criteria: *Analyze and evaluate ideas, proposals and solutions to manage a variety of problems.*

Performance Element: Use structured problem-solving methods to improve the performance of organizational and technological systems.

Measurement Criteria: *Use a structured problem-solving process to develop solutions to performance problems.*

Performance Element: Analyze information critically and judiciously to ascertain its value to whatever discipline it is applied.

Measurement Criteria: *Explain how to analyze, synthesize and evaluate information and apply its implications to a variety of avenues.*

Measurement Criteria: *Assess problem solutions to determine their appropriateness and efficiency.*

Performance Element: Synthesize elements in a problem to come up with a creative solution.

Measurement Criteria: *Break large problems down into smaller ones to solve them individually.*

Measurement Criteria: *Recognize problems to control or solve them as efficiently as possible.*

Statement: Access suitable resources to identify public policies, issues and regulations impacting AFNR management.

Performance Element: Review regulations and major laws to evaluate their impact on AFNR management.

Measurement Criteria: *Describe the major impacts of the AFNR acts.*

Measurement Criteria: *Describe the major regulations impacting the management of an individual resource.*

Measurement Criteria: *Identify situations that violate regulations.*

Performance Element: Read appropriate written material to stay abreast of current issues impacting AFNR management.

Measurement Criteria: *Identify significant issues that impact work assignment.*

Performance Element: Gather public input for AFNR management decision-making.

Measurement Criteria: *Conduct a local survey of public perceptions and desires concerning AFNR issues.*

Performance Element: Use critical thinking skills to identify, organize alternatives, and evaluate public policy issues related to AFNR.

Measurement Criteria: *Identify alternatives to an issue's potential solution.*

Measurement Criteria: *Evaluate alternatives for strengths and weaknesses.*

Measurement Criteria: *Recommend a solution based on research and analysis.*

Cluster Knowledge and Skill Statement

Information Technology Applications

Statement: Use information technology tools specific to AFNR to access, manage, integrate and create information.

Performance Element: Use Personal Information Management (PIM)/productivity applications.

Measurement Criteria: *Manage personal schedule and contact information.*

Measurement Criteria: *Create memos and notes.*

Performance Element: Use electronic mail applications.

Measurement Criteria: *Understand and identify the functions and purpose of e-mail systems.*

Measurement Criteria: *Use e-mail to communicate within and across organizations.*

Performance Element: Use Internet applications.

Measurement Criteria: *Search for and access information.*

Performance Element: Use writing/publishing applications.

Measurement Criteria: *Prepare simple reports and other business communications.*

Measurement Criteria: *Prepare complex reports and other business communications, integrating graphics and other non-text elements.*

Performance Element: Use presentation applications.

Measurement Criteria: *Prepare and deliver presentations for training, sales and information sharing.*

Performance Element: Use spreadsheet applications.

Measurement Criteria: *Perform calculations and analysis on data.*

Performance Element: Use database applications.

Measurement Criteria: *Manage, analyze and report on interrelated data elements.*

Performance Element: Use collaborative/groupware applications.

Measurement Criteria: *Facilitate group work through management of shared schedule and contact information.*

Measurement Criteria: *Facilitate group work through management of shared files and online information.*

Performance Element: Use Geographic Information System/Global Positioning System (GIS/GPS) applications.

Measurement Criteria: *Create maps.*

Measurement Criteria: *Locate people or things.*

Measurement Criteria: *Identify best route for travel.*

Performance Element: Use computer operations applications.

Measurement Criteria: *Manage computer operations.*

Measurement Criteria: *Manage file storage.*

Measurement Criteria: *Compress or alter files.*

Performance Element: Use computer-based equipment (containing embedded computers [or processors] used to control electromechanical devices).

Measurement Criteria: *Operate computer-driven equipment and machines.*

Measurement Criteria: *Use installation and operation manuals.*

Measurement Criteria: *Troubleshoot computer-driven equipment and machines and access support as needed.*

Cluster Knowledge and Skill Statement

Systems

Statement: Understand roles within teams, work units, departments, organizations, interorganizational systems, and the larger environment.

Performance Element: Examine company performance and goals to appreciate AFNR organizations and the AFNR industry.

- ***Measurement Criteria:*** *Examine the role and major functions of AFNR organizations to better utilize AFNR guidelines.*
- ***Measurement Criteria:*** *Explain the major guidelines used by AFNR organizations to manage and improve performance.*
- ***Measurement Criteria:*** *Examine economic, social and technological changes to spotlight their impact on AFNR organizations and the industry.*
- ***Measurement Criteria:*** *Explain technological changes to reveal their impact on information technology and transportation.*

Statement: Identify how key organizational systems affect organizational performance and the quality of products and services.

Performance Element: Manage and improve organizational systems to better serve customers.

- ***Measurement Criteria:*** *Evaluate customer needs to manage relationships with both internal and external customers.*
- ***Measurement Criteria:*** *Develop and manage plans and budgets to accomplish organizational goals and objectives.*
- ***Measurement Criteria:*** *Develop plans to improve organizational performance including customer satisfaction and service/operations performance.*
- ***Measurement Criteria:*** *Develop plans to maintain compliance with organizational policies and government laws and regulations.*

Performance Element: Know the components of each agricultural, natural resource, and environmental system to address their maintenance requirements.

- ***Measurement Criteria:*** *Develop management plans to improve the agricultural and natural resource systems.*
- ***Measurement Criteria:*** *Determine goals and objectives for each system to manage organizational activities more effectively.*
- ***Measurement Criteria:*** *Prepare and operate systems and technical tools to access, manage, integrate, evaluate and create information.*

Performance Element: Research geographical data to recognize the types of systems used in various geographical areas.

- ***Measurement Criteria:*** *Evaluate the effects of implementing practices to advance a system.*
- ***Measurement Criteria:*** *Explore multi-area trends to explain how systems differ across geographical areas.*

Cluster Knowledge and Skill Statement

Safety, Health, and Environmental

Statement: Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.

Performance Element: Examine required regulations to maintain/improve safety, health and environmental management systems.

Measurement Criteria: *Study appropriate resources to identify the major regulatory areas (e.g., personal protective equipment) and government laws and regulations.*

Measurement Criteria: *Examine the major system components to realize benefits of health, safety and environmental management systems in AFNR organizations.*

Measurement Criteria: *Measure or estimate benefits to explain how government agencies promote compliance and improved health, safety and environmental performance to AFNR organizations.*

Measurement Criteria: *Examine logistics, distribution and transportation organizations to explain how AFNR organizations promote improved health, safety and environmental performance.*

Performance Element: Develop a plan to maintain and improve health, safety and environmental compliance and performance.

Measurement Criteria: *Make a personal commitment to safety, health and environmental policies and procedures.*

Measurement Criteria: *Develop plans to improve health, safety and environmental performance.*

Measurement Criteria: *Educate and orient other workers.*

Performance Element: Stress the importance of safety, health and environmental responsibilities in the workplace to provide operating guidelines.

Measurement Criteria: *Establish a set of safety, health and environmental principles to ensure a high level of performance.*

Measurement Criteria: *Develop a pollution/waste prevention plan to contribute to the total productivity improvement.*

Performance Element: Examine health risks associated with a particular skill to better form personnel safety guidelines.

Measurement Criteria: *Define what level of possible contamination or injury is considered a risk in order to set safety priorities.*

Measurement Criteria: *Assess mental and physical stresses to determine all aspects necessary to perform well and what health risks are associated with both the mental and physical aspects.*

Statement: Identify health goals and safety procedures for AFNR occupations.

Performance Element: Apply safety/health precautions to participation in natural resource projects.

Measurement Criteria: *Wear personal protective equipment.*

Measurement Criteria: *Demonstrate how to avoid placing oneself in hazardous work situations.*

Cluster Knowledge and Skill Statement

Performance Element: Demonstrate recognized first aid knowledge and procedures to show how they are used by natural resource industries.

Measurement Criteria: *Complete recognized industry-level first aid training program.*

Performance Element: Identify health/safety policies and procedures for natural resource occupations.

Measurement Criteria: *Participate in safety meetings.*

Measurement Criteria: *Describe the health and safety policies and procedures relevant to the worksite and assignment.*

Statement: Demonstrate appropriate health and safety procedures for AFNR occupations.

Performance Element: Develop response plans to handle emergencies.

Measurement Criteria: *Identify various emergency response plan requirements for a facility.*

Measurement Criteria: *Develop an emergency response plan for natural disasters.*

Performance Element: Identify hazards and acquire first aid skills to promote environmental safety.

Measurement Criteria: *Identify general workplace safety hazards.*

Measurement Criteria: *Apply general workplace safety precautions/procedures.*

Measurement Criteria: *Acquire and maintain first aid certification.*

Measurement Criteria: *Acquire and maintain cardiopulmonary resuscitation (CPR) certification.*

Measurement Criteria: *Respond to medical emergencies.*

Measurement Criteria: *Explain purpose of pollution control systems.*

Measurement Criteria: *Describe procedures to comply with environmental regulations.*

Measurement Criteria: *Maintain environmental health and safety facilities.*

Measurement Criteria: *Handle chemicals and safety equipment appropriately.*

Measurement Criteria: *Explain ergonomic procedures.*

Measurement Criteria: *Assess workplace safety.*

Measurement Criteria: *Assess a safety-training plan.*

Measurement Criteria: *Observe all regulatory and safety standards.*

Cluster Knowledge and Skill Statement

Leadership and Teamwork

Statement: Use leadership skills in collaborating with others to accomplish organizational goals and objectives.

Performance Element: Embrace empowerment, risk, communication, focusing on results, decision-making, problem solution, investment in individuals, and resource use and access to develop premier leadership.

- ***Measurement Criteria:*** *Work independently and in group settings to get things done.*
- ***Measurement Criteria:*** *Focus on results.*
- ***Measurement Criteria:*** *Plan effectively.*
- ***Measurement Criteria:*** *Identify and use resources.*
- ***Measurement Criteria:*** *Communicate effectively with others.*
- ***Measurement Criteria:*** *Take risks to get the job done.*
- ***Measurement Criteria:*** *Invest in other by enabling and empowering them.*
- ***Measurement Criteria:*** *Learn from mistakes and deal with setbacks.*
- ***Measurement Criteria:*** *Evaluate and reflect on action taken (i.e., make appropriate improvements).*

Performance Element: Embrace compassion, service, listening, coaching, developing others, team development, and understanding and appreciating others to develop premier leadership.

- ***Measurement Criteria:*** *Practice the human relations skills of compassion, empathy, unselfishness, trustworthiness, reliability and listening.*
- ***Measurement Criteria:*** *Interact and work with others.*
- ***Measurement Criteria:*** *Develop others.*
- ***Measurement Criteria:*** *Eliminate barriers in building relationships.*
- ***Measurement Criteria:*** *Participate effectively as a team member.*
- ***Measurement Criteria:*** *Understand, accept, and appreciate others and their contributions.*
- ***Measurement Criteria:*** *Practice servant leadership.*

Performance Element: Embrace enthusiasm, creativity, the future, conviction, mission, courage, concept, focus, principles and change to develop premier leadership.

- ***Measurement Criteria:*** *Contemplate the future.*
- ***Measurement Criteria:*** *Persuade others to commit.*
- ***Measurement Criteria:*** *Demonstrate courage to take risks.*
- ***Measurement Criteria:*** *Live by personal mission.*
- ***Measurement Criteria:*** *Act as an agent of change.*
- ***Measurement Criteria:*** *Adapt to opportunities and obstacles.*
- ***Measurement Criteria:*** *Conceptualize ideas.*

Cluster Knowledge and Skill Statement

Performance Element: Embrace integrity, courage, values, ethics, humility, perseverance, self-discipline, and responsibility to develop premier leadership.

- ***Measurement Criteria:*** *Demonstrate virtuous behavior.*
- ***Measurement Criteria:*** *Assess own values accurately.*
- ***Measurement Criteria:*** *Live with integrity.*
- ***Measurement Criteria:*** *Practice self-discipline.*
- ***Measurement Criteria:*** *Respect others.*
- ***Measurement Criteria:*** *Accept diversity of ideas and opinions.*
- ***Measurement Criteria:*** *Accept responsibility for personal actions.*
- ***Measurement Criteria:*** *Value service to others.*

Performance Element: Include self, community, diversity, environment, global awareness and knowledge to develop premier leadership.

- ***Measurement Criteria:*** *Participate in issues important to the community.*
- ***Measurement Criteria:*** *Perform leadership tasks associated with citizenship.*
- ***Measurement Criteria:*** *Apply knowledge gained from a study of trends and issues.*
- ***Measurement Criteria:*** *Study local, state, national and global issues.*
- ***Measurement Criteria:*** *Participate in activities that promote acceptance of diversity.*
- ***Measurement Criteria:*** *Use assessment tools to gain knowledge of oneself.*

Performance Element: Embrace innovation, intuition, adaptation, life-long learning and coachability to develop premier leadership.

- ***Measurement Criteria:*** *Implement a leadership and personal growth plan.*
- ***Measurement Criteria:*** *Seek counsel from others.*
- ***Measurement Criteria:*** *Use innovative problem-solving strategies.*
- ***Measurement Criteria:*** *Adapt to emerging technologies.*
- ***Measurement Criteria:*** *Evaluate personal growth plans on a continual basis.*
- ***Measurement Criteria:*** *Implement a plan for acquiring new knowledge.*

Statement: Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.

Performance Element: Embrace attitude, exercise, goal-setting, planning, self-discipline, sense of balance, persistence and respect to develop personal growth.

- ***Measurement Criteria:*** *Practice healthy eating habits.*
- ***Measurement Criteria:*** *Respect one's own body.*
- ***Measurement Criteria:*** *Participate in a fitness program.*
- ***Measurement Criteria:*** *Set goals for long-term health.*
- ***Measurement Criteria:*** *Discipline self to lead an active, healthy life.*

Cluster Knowledge and Skill Statement

Performance Element: Embrace friendship, integrity, morals, values, etiquette, citizenship, cross-cultural awareness, acceptance/change, and respect for differences to develop personal growth.

Measurement Criteria: *Accept those different from self.*
Measurement Criteria: *Use proper social graces.*
Measurement Criteria: *Communicate effectively in groups.*
Measurement Criteria: *Relate to people across generations.*
Measurement Criteria: *Develop friendships.*
Measurement Criteria: *Maintain long-term relationships.*
Measurement Criteria: *See self in a positive way.*
Measurement Criteria: *Cope with life's trials.*

Performance Element: Embrace goal-setting, planning, decision-making, principles, respect, attitude, dependability, loyalty, trustworthiness and communication to develop personal growth.

Measurement Criteria: *Plan and implement professional goals and set priorities.*
Measurement Criteria: *Make clear decisions in one's professional life.*
Measurement Criteria: *Demonstrate professional ethics.*
Measurement Criteria: *Communicate clearly.*
Measurement Criteria: *Balance professional and personal responsibilities.*
Measurement Criteria: *Demonstrate exemplary employability skills.*

Performance Element: Embrace learning, critical thinking, reasoning, creative thinking, attitude, dependability, decision-making and problem-solving to develop personal growth.

Measurement Criteria: *Think critically.*
Measurement Criteria: *Think creatively.*
Measurement Criteria: *Practice sound decision-making.*
Measurement Criteria: *Solve problems.*
Measurement Criteria: *Commit to life-long learning.*
Measurement Criteria: *Articulate opinions to persuade others.*
Measurement Criteria: *Practice sound study skills.*
Measurement Criteria: *Maximize mental assets and compensate for mental limitations.*

Performance Element: Embrace attitude, self-discovery, coping, friendship, self-reliance, sense of balance, empathy, compassion, and integrity to develop personal growth.

Measurement Criteria: *Demonstrate coping skills.*
Measurement Criteria: *Live a compassionate and selfless life.*
Measurement Criteria: *Develop self-assurance and confidence.*
Measurement Criteria: *Embrace the maturation process.*
Measurement Criteria: *Establish emotional integrity.*
Measurement Criteria: *Seek appropriate counsel.*
Measurement Criteria: *Know emotional self.*

Cluster Knowledge and Skill Statement

Performance Element: Embrace ethics, coping, courage, attitude, self-image/worth, values, principles and sense of balance to develop personal growth.

Measurement Criteria: *Be respectful and sensitive of others' beliefs.*

Measurement Criteria: *Lead a principle-centered life based on values.*

Measurement Criteria: *Value yourself and others.*

Measurement Criteria: *Practice self-reflection.*

Measurement Criteria: *Discover and nurture a belief system.*

Cluster Knowledge and Skill Statement

Ethics and Legal Responsibilities

Statement: Know and understand the importance of professional ethics and legal responsibilities.

Performance Element: Apply knowledge of professional and workplace ethics and legal responsibilities to organize guidelines for workplace conduct.

Measurement Criteria: *Demonstrate awareness of legal responsibilities for different roles and functions within organizations.*

Measurement Criteria: *Access appropriate references to recognize differences in ethical and legal responsibilities.*

Performance Element: Apply ethical and legal reasoning to workplace situations.

Measurement Criteria: *Apply ethical reasoning to different workplace situations.*

Measurement Criteria: *Identify strategies for responding to unethical or illegal actions of individuals and organizations.*

Performance Element: Review appropriate resources to identify national and international rules associated with a desired career.

Measurement Criteria: *Research local, state, and national sources to identify the legal bodies that regulate the desired career.*

Measurement Criteria: *Research library and Internet sources to find national and international regulations that affect day-to-day operations in a desired career area.*

Performance Element: Identify what ethical issues and concerns affect a desired career field to assist in making career decisions.

Measurement Criteria: *Observe ethical behavior in the workplace to appreciate the integral role it plays in all business.*

Measurement Criteria: *Discuss ethical responsibilities in the workplace to establish guidelines for personnel/client relationships.*

Statement: Demonstrate workplace ethics specific to AFNR occupations.

Performance Element: Evidence interest and concern to demonstrate natural resource stewardship and ethics.

Measurement Criteria: *Explain how personal choices are related to natural resource sustainability.*

Performance Element: Exercise personal habits and actions to demonstrate workplace ethics.

Measurement Criteria: *Explain how personal workplace actions can affect the resource.*

Cluster Knowledge and Skill Statement

Employability and Career Development

Statement: Know and understand the importance of employability skills.

Performance Element: Apply critical thinking skills and decision-making to exhibit qualifications for entering a career.

Measurement Criteria: *Explain written organizational policies, rules and procedures to guide employees in workplace behavior.*

Measurement Criteria: *Identify and demonstrate positive work behaviors and personal qualities required to uphold quality standards.*

Measurement Criteria: *Relate critical thinking skills in workplace situations to decision-making, creativity and quality performance.*

Performance Element: Identify career opportunities to help develop career plans.

Measurement Criteria: *Identify and explore career opportunities in one or more career pathways to discover personal preferences.*

Measurement Criteria: *Develop career plans for career opportunities.*

Statement: Explore, plan and effectively manage personal career options.

Performance Element: Manage employment relations to hunt for and land a job.

Measurement Criteria: *Seek, apply for, and accept employment to begin career objectives.*

Measurement Criteria: *Evaluate and compare employment opportunities to find the best job available based on sensible expectations.*

Performance Element: Know the standards and qualifications that must be met in order to enter a given industry.

Measurement Criteria: *Discuss employability in a given industry and factors that affect it in order to evaluate salaries and opportunities.*

Measurement Criteria: *Organize an educational plan to acquire the skills needed in order to join an industry of choice.*

Performance Element: Understand how advancement and the promotional ladder work within an industry to plan career objectives.

Measurement Criteria: *Determine the chain of command for a particular industry to evaluate your personal skills and potential.*

Measurement Criteria: *Explain what projects need to be accomplished or what skills need to be acquired to gain a promotion.*

Cluster Knowledge and Skill Statement

Technical Skills

Statement: Use the technical knowledge and skills required to pursue the full range of careers for all AFNR pathways, including knowledge of design, operation, and maintenance of technological systems critical to AFNR careers.

Performance Element: Use technological systems to accomplish objectives in transportation.

- ***Measurement Criteria:*** *Evaluate transportation needs to explain the role and function of critical transportation-related technological systems.*
- ***Measurement Criteria:*** *Measure and manage the reliability and performance of technological systems to establish use and maintenance guidelines.*
- ***Measurement Criteria:*** *Manage major health, safety and environmental risks to minimize their potential impact on technological systems.*

Performance Element: Select and improve utilization of technological systems to improve production and products.

- ***Measurement Criteria:*** *Develop acceptable criteria to evaluate and select technological systems.*
- ***Measurement Criteria:*** *Participate in efforts to improve the utilization and performance of technological systems.*

Performance Element: Identify technical skills needed to run an industry efficiently.

- ***Measurement Criteria:*** *Identify types of skills needed to succeed in a desired industry.*
- ***Measurement Criteria:*** *Explore methods available to develop technical skills.*
- ***Measurement Criteria:*** *Correctly operate the tools associated with a specific skill.*

Performance Element: Establish criteria to identify areas that have special needs for technical skills.

- ***Measurement Criteria:*** *Classify workplace occupations to determine what types of skills are considered technical skills.*
- ***Measurement Criteria:*** *Evaluate processes and products to determine what areas most often use technical skills.*

Statement: Use tools, equipment, machinery and technology to work in areas related to AFNR.

Performance Element: Select the appropriate tool to perform a given task.

- ***Measurement Criteria:*** *Select tools and equipment.*
- ***Measurement Criteria:*** *Identify standard tools, equipment, and safety procedures.*
- ***Measurement Criteria:*** *Follow operating instructions.*
- ***Measurement Criteria:*** *Set up/Adjust tools and equipment.*
- ***Measurement Criteria:*** *Maintain tools.*
- ***Measurement Criteria:*** *Store tools.*

Performance Element: Keep natural resource tools in good working order for efficient work use.

- ***Measurement Criteria:*** *Demonstrate how to check tool condition before use.*
- ***Measurement Criteria:*** *Describe the characteristics of a tool in need of maintenance.*
- ***Measurement Criteria:*** *Demonstrate how to replace tool parts and components as needed.*

Cluster Knowledge and Skill Statement

Performance Element: Wear protective equipment and handle natural resource tools and equipment with skill to demonstrate safe use of tools and equipment.

Measurement Criteria: *Wear appropriate personal protective equipment (PPE).*

Measurement Criteria: *Demonstrate proper spacing distance from others when using tools.*

Measurement Criteria: *Check tools for safety before using.*

Measurement Criteria: *Store tools with appropriate safety precautions.*

Measurement Criteria: *Demonstrate the proper usage of a tool or piece of equipment.*

Measurement Criteria: *Describe regulations for the use of tools and equipment.*

Performance Element: Use tools and assisting devices to demonstrate the use of technology to expand human capacity for natural resource tasks.

Measurement Criteria: *Use appropriate tools to assist in lifting and moving.*

Measurement Criteria: *Demonstrate use of knots, ropes, lines and attachments.*

Measurement Criteria: *Use geo-spatial and mapping techniques (GIS/GPS).*

Performance Element: Select the appropriate tool to accomplish a given task.

Measurement Criteria: *Demonstrate the ability to select the appropriate tool to complete the work assignment.*

Performance Element: Maintain tools for efficient work use.

Measurement Criteria: *Demonstrate how to check tool condition before use.*

Measurement Criteria: *Describe the characteristics of a tool in need of maintenance.*

Measurement Criteria: *Demonstrate how to replace tool parts and components as needed.*

Measurement Criteria: *Maintain a preventive maintenance schedule.*

Measurement Criteria: *Maintain equipment according to owner's manual specifications.*

Measurement Criteria: *Maintain and repair pump.*

Performance Element: Wear protective equipment and observe safety and operational guidelines to use tools and equipment effectively.

Measurement Criteria: *Wear appropriate personal protective equipment (PPE).*

Measurement Criteria: *Check tools for safety before using.*

Measurement Criteria: *Store tools with appropriate safety precautions.*

Measurement Criteria: *Describe regulations for the use of tools and equipment.*

Measurement Criteria: *Operate vehicles (pickup trucks, four-wheel-drive vehicles, tractors, vehicles with attachments, rig-up trucks, graders, backhoe tractors, front-end loaders, excavators, scrappers, cranes, watercraft).*

Measurement Criteria: *Operate applicable pumps (diesel and gas engines, centrifugal pumps, positive displacement pumps, air and gas compressors).*

Measurement Criteria: *Operate applicable miscellaneous equipment (hoists, winches, pulleys, boilers and associated equipment, drilling equipment).*

Measurement Criteria: *Operate applicable electronic equipment (electrical distribution systems, electronic survey equipment, generators).*

Statement: Compare and contrast issues affecting the AFNR industry, biotechnology, employment, safety, environmental, animal welfare).

Performance Element: Determine, analyze and present solutions for different environmental issues.

Measurement Criteria:

Identify issues affecting the industry.

Measurement Criteria: *Research history and policies related to the issue.*

Measurement Criteria: *Identify conflicting points of view.*

Measurement Criteria: *Determine effects of the issue on the industry.*

Measurement Criteria: *Determine potential resolutions to the issue.*

Performance Element: Learn economic principles in order to apply them to natural resource systems (i.e., supply, demand and profit).

Measurement Criteria: *Describe the effect of compound interest on natural resource investments.*

Measurement Criteria: *Describe the economic impacts of natural resource preservation vs. use of the resource.*

Measurement Criteria: *Describe the potential for entrepreneurial opportunities in natural resources.*

Measurement Criteria: *Describe the impacts of natural resource decisions on global markets and environmental health.*

Performance Element: Apply skills with computer software to accomplish a variety of business activities.

Measurement Criteria: *Demonstrate understanding of operating and design software systems; e.g., CAD, Windows.*

Measurement Criteria: *Discuss and use basic software such as spreadsheet, word processing.*

Measurement Criteria: *Show ability to perform software installation.*

Measurement Criteria: *Show ability to use diagnostic program.*

Performance Element: Access the Internet and use e-mail to demonstrate the ability to network and interface with technology.

Measurement Criteria: *Demonstrate general understanding of local area network.*

Measurement Criteria: *Navigate global Internet sites as a resource.*

Measurement Criteria: *Demonstrate skills in linking information from various sources.*

Measurement Criteria: *Show competency with e-mail and wireless communications.*

Statement: Envision emerging technology and globalization to project its influence on widespread markets.

Performance Element: Examine new technologies to project their impact in the global market of technology.

Measurement Criteria: *Convert drawings from US Standard to metric.*

Measurement Criteria: *Identify ways that global regulations impact system designs.*

Measurement Criteria: *Identify and discuss use of new technologies (such as lasers and robotics) and their impact on agricultural systems.*

Measurement Criteria: *Discuss the importance of new communication systems and how they impact ag systems.*

Performance Element: Relate the advance of technology to the need for Continuing Education/Career Development.

Measurement Criteria: *Research and discuss emerging technologies and the skills they require.*

Measurement Criteria: *Discuss history of systems over the last century and discuss how emerging technology and career training will be essential to meet market demands.*

Section III – Pathway Knowledge and Skills

PATHWAY: Food Products and Processing Systems

Pathway Topic: Food Products and Processing Systems Topics

Pathway KS Statement: Apply principles of food processing to the food industry.

Performance Element: Develop management plans to maintain equipment and facilities.

Measurement Criteria: *Develop and maintain a Standard Sanitation Operating Procedure (SSOP).*

Measurement Criteria: *Explain and demonstrate Good Manufacturing Practices (GMP), including employee safety.*

Performance Element: Interpret and follow, develop and implement Hazard Analysis Critical Control Point (HACCP) procedures to establish operating parameters.

Measurement Criteria: *Conduct a hazard analysis.*

Measurement Criteria: *Identify Critical Control Points (CCP).*

Measurement Criteria: *Establish critical limits for each Critical Control Point (CCP).*

Measurement Criteria: *Establish monitoring procedures.*

Measurement Criteria: *Establish corrective actions.*

Measurement Criteria: *Establish verification procedures.*

Pathway KS Statement: Apply principles of food science to the food industry.

Performance Element: Apply food science principles to enhance product development.

Measurement Criteria: *Conduct research.*

Measurement Criteria: *Apply the use of chemistry.*

Measurement Criteria: *Comply and apply USDA/FDA standards.*

Measurement Criteria: *Use product development (e.g., consumer opinion, taste testing).*

Measurement Criteria: *Conduct nutritional analysis (e.g., biochemistry).*

Measurement Criteria: *Compare and contrast the nutritive value of food groups.*

Measurement Criteria: *Identify and compare various food constituents.*

Pathway KS Statement: Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.

Performance Element: Analyze product preparation options to prepare products for distribution.

Measurement Criteria: *Conduct micro-test.*

Measurement Criteria: *Interpret and perform quality assurance tests (e.g., fat, moisture, protein).*

Measurement Criteria: *Demonstrate approved product handling techniques.*

Measurement Criteria: *Use weights and measures (e.g., US , metric) to formulate product.*

Measurement Criteria: *Demonstrate documentation techniques.*

Measurement Criteria: *Package products.*

Measurement Criteria: *Store products.*

Performance Element: Compare and select food preservation methods to develop food preservation programs.

Pathway Topic: Food Products and Processing Systems Topics

Measurement Criteria: *Calculate and inventory parts per million (ppm) of restricted ingredients (e.g., milk).*

Measurement Criteria: *Explain methods of chemical preservation (e.g., pH, salt, water activity [aw], additives).*

Measurement Criteria: *Explain the impact of temperature in food preservation.*

Measurement Criteria: *Compare and contrast packaging preservation (e.g., film, plastic, can).*

Measurement Criteria: *Compare and contrast process preservation (e.g., irradiation, pasteurization, sterilization).*

Pathway KS Statement: Identify processing, handling, and storage factors to show how they impact product quality and safety.

Performance Element: Develop a "quality factors program" to comply with local, national, governmental, and international standards.

Measurement Criteria: *Perform and interpret quality check of food products per industry standards.*

Measurement Criteria: *Explain methods of food storage to assure product quality.*

Measurement Criteria: *Interpret and follow industry/government standards.*

Performance Element: Develop slaughter/inspection techniques to process food products and analyze food product options.

Measurement Criteria: *Demonstrate approved techniques for preparing ready-to-eat food products.*

Measurement Criteria: *Compare and contrast slaughter techniques (e.g., zero tolerance).*

Measurement Criteria: *Conduct pre-mortem and post-mortem inspections.*

Measurement Criteria: *Process meat and poultry products.*

Measurement Criteria: *Process dairy products.*

Measurement Criteria: *Process fruits and vegetables.*

Measurement Criteria: *Process grains.*

Measurement Criteria: *Process bio-engineered foods.*

Measurement Criteria: *Select raw materials for processing.*

PATHWAY: Plant Systems

Pathway Topic: Plant Systems Topic

Pathway KS Statement: Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.

Performance Element: Analyze and evaluate nutritional requirements and environmental conditions to develop and implement a fertilization plan.

Measurement Criteria: *Describe nutrient sources.*
Measurement Criteria: *Determine plant nutrient requirements for optimum growth.*
Measurement Criteria: *Identify function of plant nutrients in plants.*
Measurement Criteria: *Determine the environmental factors that influence and optimize plant growth.*
Measurement Criteria: *Apply nutrients to plants for economic growth.*
Measurement Criteria: *Describe nutrient application methods and appropriate practices.*

Performance Element: Test appropriate materials or examine data to evaluate and manage soil/media nutrients.

Measurement Criteria: *Collect and test soil/media and/or plant tissue.*
Measurement Criteria: *Interpret tests of soil/media and/or plant tissue.*
Measurement Criteria: *Identify soil slope, structure and type.*
Measurement Criteria: *Evaluate soil/media permeability and water-holding capacity.*
Measurement Criteria: *Determine the chemical properties of soil/media.*
Measurement Criteria: *Determine land use capability.*
Measurement Criteria: *Determine the biological functions of microorganisms of soil/media.*

Performance Element: Explain and use basic methods for reproducing and propagating plants.

Measurement Criteria: *Determine the role of genetics in plants.*
Measurement Criteria: *Describe the components and functions of plant reproductive parts.*
Measurement Criteria: *Identify and practice methods of asexual/sexual plant propagation.*
Measurement Criteria: *Describe the principles of plant micro-propagation.*
Measurement Criteria: *Apply principles and practices of biotechnology to plant propagation.*

Performance Element: Develop and use a plan for integrated pest management.

Measurement Criteria: *Identify plant pests (e.g., insects, diseases, weeds, rodents).*
Measurement Criteria: *Determine pest management safety practices.*
Measurement Criteria: *Determine pest management methods.*
Measurement Criteria: *Develop pest management plans based on pest life cycles.*
Measurement Criteria: *Implement pest control plan with appropriate treatments.*
Measurement Criteria: *Evaluate pest control plan.*
Measurement Criteria: *Prevent, identify and manage pest resistance.*

Pathway KS Statement: Address taxonomic or other classifications to explain basic plant anatomy and physiology.

Pathway Topic: Plant Systems Topic

Performance Element: Examine unique plant properties to identify/describe functional differences in plant structures including roots, stems, flowers, leaves and fruit.

Measurement Criteria: *Identify plant structures (e.g., seeds).*

Measurement Criteria: *Describe physiological functions of plants.*

Measurement Criteria: *Describe germination process and conditions.*

Performance Element: Classify plants based on physiology for taxonomic or other classifications.

Measurement Criteria: *Classify plants as monocots or dicots.*

Measurement Criteria: *Classify plants as annuals, biennials or perennials.*

Measurement Criteria: *Classify plants according to growth habit.*

Measurement Criteria: *Classify plants by type.*

Measurement Criteria: *Classify plants by economic value.*

Pathway KS Statement: Apply fundamentals of production and harvesting to produce plants.

Performance Element: Apply fundamentals of plant management to develop a production plan.

Measurement Criteria: *Identify and select seeds and plants.*

Measurement Criteria: *Manipulate and evaluate environmental conditions (e.g., irrigation, mulch, shading) to foster plant germination, growth and development.*

Measurement Criteria: *Evaluate and demonstrate planting practices (e.g., population rate, germination/seed vigor, inoculation, seed and plant treatments).*

Measurement Criteria: *Evaluate and demonstrate transplanting practices.*

Measurement Criteria: *Prepare soil/media for planting.*

Measurement Criteria: *Control plant growth (e.g., pruning, pinching, disbudding, topping, detasseling, staking, cabling, shearing, shaping).*

Measurement Criteria: *Prepare plants and plant products for distribution.*

Performance Element: Apply fundamentals of plant management to harvest, handle and store crops.

Measurement Criteria: *Determine crop maturity.*

Measurement Criteria: *Identify harvesting practices and equipment.*

Measurement Criteria: *Demonstrate common harvesting techniques.*

Measurement Criteria: *Calculate yield and loss.*

Measurement Criteria: *Identify options for crop storage.*

Measurement Criteria: *Maintain quality of plant products in storage.*

Measurement Criteria: *Prepare plants and plant products for distribution.*

Pathway KS Statement: Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, farm).

Performance Element: Apply basic design elements and principles to create a design using plants.

Measurement Criteria: *Conduct a site evaluation for physical condition and design*

Pathway Topic: Plant Systems Topic

implications.

Measurement Criteria: *Apply elements of design (e.g., line, form, texture, color).*

Measurement Criteria: *Incorporate principles of design (e.g., space, scale, proportion, order).*

Measurement Criteria: *Use landscape design drawing tools including Computer Aided Design (CAD) and industry-specific software.*

Measurement Criteria: *Select hard goods, supplies and tools used in design.*

Measurement Criteria: *Select plant(s) for design.*

PATHWAY: Animal Systems

Pathway Topic: Animal Systems Topic

Pathway KS Statement: Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.

Performance Element: Use classification systems to explain basic functions of animal anatomy and physiology.

Measurement Criteria: *Describe functional differences in animal structures and body systems.*

Measurement Criteria: *Classify animals according to anatomy and physiology.*

Performance Element: Recognize the anatomy of animal species to understand how the body structures interact and affect animal health.

Measurement Criteria: *Identify selected animal parts from a diagram or on a real animal.*

Measurement Criteria: *Identify ways that an animal's health can be affected by anatomy/physiology problems.*

Performance Element: Analyze a subject animal to determine the nature of its health status.

Measurement Criteria: *Perform simple procedures in evaluating an animal's health status.*

Measurement Criteria: *Identify symptoms of diseases, illnesses, parasites, and other health-related problems.*

Measurement Criteria: *Diagnose animal ailments.*

Measurement Criteria: *Implement disease prevention and health improvement program.*

Measurement Criteria: *Identify and implement (i.e., treat) treatment options.*

Pathway KS Statement: Recognize animal behaviors to facilitate working with animals safely.

Performance Element: Develop a safety plan for working with a specific animal.

Measurement Criteria: *Explain factors which serve to stimulate or discourage given types of animal behavior.*

Measurement Criteria: *Recognize the normality curve of animal behavior.*

Measurement Criteria: *Perform safe handling procedures when working with animals.*

Measurement Criteria: *Identify strengths and weaknesses of an animal safety handling plan.*

Measurement Criteria: *Operate animal facilities to insure safety of animals.*

Pathway KS Statement: Provide proper nutrition to maintain animal performance.

Performance Element: Examine animal developmental stages to comprehend why nutrient requirements are different throughout an animal's life cycle.

Measurement Criteria: *Recognize the different phases of an animal's life cycle.*

Measurement Criteria: *Select diets which provide the appropriate quantity of nutrients for each animal developmental stage.*

Performance Element: Analyze a feed ration to determine whether or not it fulfills a given animal's nutrient requirements.

Pathway Topic: Animal Systems Topic

Measurement Criteria: *Identify the differences between good and poor quality feedstuffs.*

Measurement Criteria: *Create a balanced ration for a given animal.*

Performance Element: Record and compare feed variations to assess whether the nutritional requirements of a given animal are being met.

Measurement Criteria: *Use different types of feedstuffs (e.g., roughage, concentrates) to create a feed ration containing the appropriate amounts of required nutrients.*

Measurement Criteria: *Use different forms of feedstuffs (e.g., pellets, cracked, rolled, ground) to create a diet that meets the needs of a specific animal.*

Pathway KS Statement: Know the factors that influence an animal's reproductive cycle to explain species response.

Performance Element: Analyze elements in the reproductive cycle to explain differences between male and female reproductive systems.

Measurement Criteria: *Identify the parts of male and female reproductive tracts on example animals.*

Measurement Criteria: *Analyze the reproductive cycle of a given animal.*

Measurement Criteria: *Evaluate animal readiness for breeding.*

Performance Element: Discuss reproductive cycles to show how they differ from species to species.

Measurement Criteria: *Discuss the pros and cons of breeding through natural cover and artificial insemination.*

Measurement Criteria: *Discuss the implications of genetic variation.*

Measurement Criteria: *Describe techniques of artificial insemination.*

Measurement Criteria: *Identify reproduction management practices (e.g., male to female ratios, age and weight for breeding, fertility and soundness for breeding, heat synchronization, flushing).*

Performance Element: Evaluate an animal to determine its breeding soundness.

Measurement Criteria: *Describe the procedure for determining an animal's breeding readiness.*

Measurement Criteria: *Identify and prevent problems associated with reproduction.*

Measurement Criteria: *Select animals based on breeding soundness.*

Pathway KS Statement: Identify environmental factors that affect an animal's performance.

Performance Element: Recognize optimum performance for a given animal species.

Measurement Criteria: *Identify good performance for a given animal species.*

Measurement Criteria: *Identify reasons why some animals perform better than others.*

Performance Element: Create a program to develop an animal to its highest potential performance.

Measurement Criteria: *Identify factors that can be manipulated to control a given animal's performance.*

Measurement Criteria: *Generate ways to increase an animal's performance.*

Performance Element: Assess an animal to determine if it has reached its optimum

Pathway Topic: Animal Systems Topic

performance level.

Measurement Criteria: *Make appropriate changes in an animal's environment in order to achieve optimum performance.*

Measurement Criteria: *Use appropriate tools in manipulating animal performance.*

Performance Element: Develop efficient procedures to produce consistently high-quality animals, well-suited for their intended purpose.

Measurement Criteria: *Identify a given species' desirable production numbers (e.g., birth weight, rate of gain, age of maturity, age of sexual maturity).*

Measurement Criteria: *Evaluate desired traits (e.g., production) of animals.*

Measurement Criteria: *Evaluate the role that economics plays in animal production.*

Measurement Criteria: *Design facilities appropriate for the production of a given species of animal.*

Measurement Criteria: *Make decisions on using new techniques and methods in the production facility so that both profit and animal safety are maximized.*

PATHWAY: Power, Structural & Technical Systems

Pathway Topic: Science

Pathway KS Statement: Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Performance Element: Relate power generation to energy sources.

Measurement Criteria: *Identify petroleum sources (e.g., gasoline, diesel).*

Measurement Criteria: *Identify alternative sources (e.g., ethanol, biodiesel, air, wood, geothermal, solar).*

Measurement Criteria: *Compare environmental impact of energy sources.*

Measurement Criteria: *Compare efficiency of energy source.*

Measurement Criteria: *Compare characteristics of energy sources.*

Measurement Criteria: *Discuss efficiency of systems (e.g., fuel cells, chemical, wind, hydro, nuclear, electric, mechanical, solar, biological).*

Performance Element: Apply principles of lubricants to sort and classify lubricants.

Measurement Criteria: *Classify lubricants and determine applications.*

Measurement Criteria: *Identify viscosity and strengths of lubricants.*

Measurement Criteria: *Describe properties of lubricants.*

Pathway Topic: Power

Pathway KS Statement: Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Performance Element: Perform scheduled service routines to maintain machinery and equipment.

Measurement Criteria: *Lubricate machinery and equipment.*

Measurement Criteria: *Ensure presence and function of safety systems and hardware.*

Measurement Criteria: *Service electrical systems.*

Measurement Criteria: *Perform machine adjustments (e.g., belts, drive chains).*

Measurement Criteria: *Service filtration systems.*

Measurement Criteria: *Maintain fluid levels.*

Measurement Criteria: *Maintain vehicle, machinery and equipment cleanliness and appearance.*

Measurement Criteria: *Maintain fluid conveyance components, (e.g., hoses and lines, valves, nozzles).*

Measurement Criteria: *Design a preventive maintenance schedule.*

Measurement Criteria: *Identify causes of malfunctions and failures.*

Measurement Criteria: *Calibrate metering, monitoring, and sensing equipment.*

Performance Element: Observe rules of the road to operate machinery and equipment.

Measurement Criteria: *Describe function of machine controls and instrumentation.*

Measurement Criteria: *Perform appropriate start-up procedures.*

Measurement Criteria: *Select proper machine(s) for specific task(s).*

Measurement Criteria: *Safely operate equipment.*

Pathway Topic: Power

Measurement Criteria: *Perform pre-operation inspection.*

Measurement Criteria: *List applicable laws for on- and off-highway operation.*

Pathway KS Statement: Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

Performance Element: Troubleshoot problems and evaluate performance to service and repair the components of internal combustion engines.

Measurement Criteria: *Describe principles of operation.*

Measurement Criteria: *Identify engine systems and components.*

Measurement Criteria: *Analyze and troubleshoot engine.*

Measurement Criteria: *Perform overhaul procedures.*

Measurement Criteria: *Evaluate engine performance through post-rebuild testing.*

Performance Element: Follow manufacturers' guidelines to service and repair power transmission systems.

Measurement Criteria: *Describe features, benefits, and applications of various power transmission systems.*

Measurement Criteria: *Describe principles of operation of various power transmission systems.*

Measurement Criteria: *Perform calculations involving speed, torque and power relationships.*

Measurement Criteria: *Describe features, benefits, and applications of mechanical transmission components (e.g., belts, chains, gears, bearings, seals, universals).*

Measurement Criteria: *Inspect, analyze, and repair hydrostatic transmissions.*

Measurement Criteria: *Inspect, analyze, and repair differentials and final drives.*

Measurement Criteria: *Inspect, analyze, and repair clutches and brakes.*

Measurement Criteria: *Inspect, analyze, and repair gear-type transmissions including power shift.*

Measurement Criteria: *Inspect, analyze, and repair auxiliary drives.*

Performance Element: Evaluate performance and check maintenance manuals to service and repair hydraulic systems.

Measurement Criteria: *Describe features, benefits, and applications of types of hydraulic systems.*

Measurement Criteria: *Describe physical principles of operation.*

Measurement Criteria: *Interpret symbols and schematic drawings.*

Measurement Criteria: *Describe the application and operation of major components.*

Measurement Criteria: *Inspect, analyze, and repair hydraulic components (e.g., pumps, valves).*

Measurement Criteria: *Inspect, analyze, and repair fluid conveyance components (e.g., hoses, lines).*

Measurement Criteria: *Evaluate system cleanliness.*

Measurement Criteria: *Identify hydraulic fittings and ports.*

Performance Element: Troubleshoot from schematics to service vehicle electrical systems.

Pathway Topic: Power

Measurement Criteria: *Describe features and applications of electrical systems.*

Measurement Criteria: *Interpret symbols and wiring diagrams.*

Measurement Criteria: *Test and troubleshoot electrical systems and components (e.g., battery, charging, starting, lighting, instrumentation, accessories).*

Measurement Criteria: *Troubleshoot and install instrumentation and data acquisition system (e.g., Global Positioning System (GPS), spraying, planting, harvesting monitors).*

Measurement Criteria: *Diagnose and repair control systems and sensors (e.g., engine, transmission, implement).*

Performance Element: Use company diagrams and schematics to service vehicle heating and air conditioning systems.

Measurement Criteria: *Describe physical principles of operation.*

Measurement Criteria: *Interpret symbols and diagrams.*

Measurement Criteria: *Test, troubleshoot, and replace heating and air-conditioning components (e.g., compressor, expansion valve, receiver dryer, pump, hoses).*

Measurement Criteria: *Evacuate and charge air conditioning systems.*

Performance Element: Check performance parameters to service and repair steering, suspension, traction, and vehicle performance systems.

Measurement Criteria: *Evaluate traction, ballasting, and weight transfer.*

Measurement Criteria: *Evaluate vehicle stability.*

Measurement Criteria: *Determine optimum vehicle performance, e.g., horsepower management, fuel efficiency.*

Measurement Criteria: *Troubleshoot, adjust, and repair suspension systems.*

Measurement Criteria: *Inspect and repair steering systems.*

Performance Element: Use tools in the workplace to demonstrate safe use and proper skills with construction/fabrication hand tools.

Measurement Criteria: *Demonstrate proper use of measurement and layout tools.*

Measurement Criteria: *Apply proper use of measurement and layout tools in construction/fabrication of an actual project.*

Measurement Criteria: *Demonstrate safe and proper techniques in using hand and power tools in construction/fabrication.*

Measurement Criteria: *Demonstrate hand and power tool use to construct/fabricate an actual project according to blueprints or plans.*

Measurement Criteria: *Identify and demonstrate proper hand and power tool maintenance procedures.*

Pathway Topic: Structural Systems

Pathway KS Statement: Exercise basic skills in blueprint and design development to create sketches, drawings and plans.

Performance Element: Use computer skills to develop simple sketches and plans.

Measurement Criteria: *Use current technology to develop simple plans and sketches.*

Measurement Criteria: *Identify symbols and drawing techniques used to develop simple plans and sketches.*

Pathway Topic: Structural Systems

Measurement Criteria: *Use scale measurement and dimension to develop simple plans and sketches.*

Pathway KS Statement: Read and relate structural plans to specifications and building codes.

Performance Element: Examine blueprints and local codes to develop a logical construction plan.

Measurement Criteria: *Identify parts of a plan or blueprint.*

Measurement Criteria: *Identify criteria for different views of a plan or blueprint.*

Measurement Criteria: *Locate elements of a construction plan and develop a construction plan.*

Measurement Criteria: *Identify local code enforcement agencies and procedures.*

Measurement Criteria: *Read and interpret local code information.*

Measurement Criteria: *Complete permit applications.*

Pathway KS Statement: Examine structural requirements to estimate project costs.

Performance Element: Use bids and billing information to develop a complete materials list and project cost estimate.

Measurement Criteria: *Identify materials used in agricultural construction/fabrication.*

Measurement Criteria: *Explain proper criteria for material use.*

Measurement Criteria: *Identify elements of project cost estimate (materials, labor, administrative, etc.).*

Measurement Criteria: *Explain selection process of all construction materials.*

Measurement Criteria: *Estimate and select type and quantities of material and other costs associated with a specified project plan.*

Measurement Criteria: *Prepare a bid package for a planned project.*

Pathway KS Statement: Develop skills required to use construction/fabrication equipment and tools.

Performance Element: Use tools in the workplace to demonstrate safe use and proper skills with construction/fabrication hand tools.

Measurement Criteria: *Demonstrate proper use of measurement and layout tools.*

Measurement Criteria: *Apply proper use of measurement and layout tools in construction/fabrication of an actual project.*

Measurement Criteria: *Demonstrate safe and proper techniques in using hand and power tools in construction/fabrication.*

Measurement Criteria: *Demonstrate hand and power tool use to construct/fabricate an actual project according to blueprints or plans.*

Measurement Criteria: *Identify and demonstrate proper hand and power tool maintenance procedures.*

Pathway KS Statement: Plan, implement, manage, and/or provide support services to facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.

Performance Element: Design machinery and equipment including vehicles, implements, building, and facilities (e.g., feeding, feed storage).

Measurement Criteria: *Analyze site/equipment/permit requirements.*

Pathway Topic: Structural Systems

Measurement Criteria: *Develop drawings.*

Measurement Criteria: *Estimate material needs and costs.*

Measurement Criteria: *Operate Computer Aided Drafting Design (CADD) Software.*

Performance Element: Follow architectural and mechanical plans to construct buildings and facilities.

Measurement Criteria: *Identify and select appropriate building materials.*

Measurement Criteria: *Install plumbing equipment and fixtures.*

Measurement Criteria: *Construct with wood and metal.*

Measurement Criteria: *Install electrical wiring components and fixtures.*

Measurement Criteria: *Paint or protect with coatings.*

Measurement Criteria: *Insulate facility.*

Measurement Criteria: *Install fencing.*

Measurement Criteria: *Install glass, ridged plastic panels and/or film plastic.*

Measurement Criteria: *Construct with concrete, stone, and brick.*

Pathway Topic: Technical Systems

Pathway KS Statement: Use the variety of tools available in computer systems to accomplish fast, accurate production in the workplace.

Performance Element: Identify and explain various types of hardware systems to show their applications potential.

Measurement Criteria: *Identify and describe individual components of each system.*

Measurement Criteria: *Discuss various types of diagnostic equipment.*

Measurement Criteria: *Be able to show aptitude in use of various equipment.*

Measurement Criteria: *Demonstrate competency on cable through put and set up.*

Pathway KS Statement: Use available power sources to plan and apply control systems.

Performance Element: Measure with selected instruments to demonstrate knowledge of basic electricity.

Measurement Criteria: *Show proficiency in use of various meters.*

Measurement Criteria: *Discuss importance of and techniques for grounding.*

Measurement Criteria: *Show understanding of codes and regulations.*

Measurement Criteria: *Discuss various energy sources.*

Performance Element: Reference electrical drawings to design, install, and troubleshoot control systems.

Measurement Criteria: *Develop and read schematic drawings for a control system.*

Measurement Criteria: *Identify and describe uses of various components of control systems; i.e., transistors, relays, HVAC, logic controllers.*

Measurement Criteria: *Discuss the importance of maintenance schedules.*

Measurement Criteria: *Identify system performance problems and apply troubleshooting techniques.*

Pathway KS Statement: Explain geospatial technology to demonstrate its applications.

Performance Element: Employ appropriate techniques to demonstrate application of GIS/GPS systems principles.

Pathway Topic: Technical Systems

Measurement Criteria: *Explain the concept and principles.*

Measurement Criteria: *Describe equipment.*

Measurement Criteria: *List techniques used.*

Measurement Criteria: *Explain the application of GIS/GPS systems with map development output.*

Performance Element: Use computer applications to produce maps that reflect surveying and mapping principles.

Measurement Criteria: *Understand and use various equipment.*

Measurement Criteria: *Perform survey and produce map using computer techniques.*

Performance Element: Select an area of personal expertise to demonstrate knowledge of end applications.

Measurement Criteria: *Apply knowledge and experience to a specific application or project to show competency; i.e., calibration, volumetric controlling, electrical design.*

PATHWAY: Natural Resources Systems

Pathway Topic: Natural Resource Systems Topics

Pathway KS Statement: Recognize importance of resource and human interrelations to conduct management activities in natural habitats.

Performance Element: Identify resource management components to establish relationships in natural resource systems.

Measurement Criteria: *Identify natural resources.*

Measurement Criteria: *Identify organizations and agencies involved in resource management.*

Measurement Criteria: *Identify impacts by humans on natural resources.*

Measurement Criteria: *Describe ecosystem relationships.*

Measurement Criteria: *Create habitat management plan.*

Performance Element: Apply cartographic skills to natural resource activities.

Measurement Criteria: *Describe different types of maps.*

Measurement Criteria: *Interpret map features and legend.*

Measurement Criteria: *Determine map scale and actual distance.*

Measurement Criteria: *Determine direction from map.*

Measurement Criteria: *Determine elevation and terrain features from topographic maps.*

Measurement Criteria: *Use directional tools with map to locate position.*

Measurement Criteria: *Use land survey and coordinate system.*

Measurement Criteria: *Use Geographic Information System to interface geospatial data.*

Measurement Criteria: *Interpret photos and images.*

Performance Element: Monitor natural resource status to obtain planning data.

Measurement Criteria: *Conduct resource inventory and population studies.*

Measurement Criteria: *Establish sample plots and points.*

Measurement Criteria: *Locate and identify resources.*

Measurement Criteria: *Collect data concerning resource availability and health.*

Measurement Criteria: *Maintain databases of resource data.*

Measurement Criteria: *Use a Geographic Information System to analyze resource data.*

Measurement Criteria: *Prepare a technical report.*

Measurement Criteria: *Describe the relationship of harvest levels to long-term availability of resources.*

Performance Element: Employ environmental and wildlife knowledge to demonstrate natural resource enhancement techniques.

Measurement Criteria: *Demonstrate stream enhancement techniques.*

Measurement Criteria: *Demonstrate forest stand improvement techniques.*

Measurement Criteria: *Demonstrate wildlife habitat enhancement techniques.*

Measurement Criteria: *Demonstrate range enhancement techniques.*

Measurement Criteria: *Demonstrate recreation area enhancement techniques.*

Performance Element: Examine weather and other criteria to recognize dangers related to work in an outdoor environment.

Pathway Topic: Natural Resource Systems Topics

Measurement Criteria: *Recognize weather-related dangers.*

Measurement Criteria: *Recognize hazards as they relate to terrain.*

Measurement Criteria: *Recognize poisonous plants and animals.*

Measurement Criteria: *Recognize hazardous situations at the work location.*

Performance Element: Learn applicable rules or laws to demonstrate natural resource mitigation techniques.

Measurement Criteria: *Demonstrate mitigation techniques.*

Pathway KS Statement: Use effective venues to communicate natural phenomena to the public.

Performance Element: Communicate natural resource information to the general public.

Measurement Criteria: *Set up and staff a display booth that communicates a natural resource topic during a community event.*

Measurement Criteria: *Develop a public use area to explain natural resources.*

Measurement Criteria: *Participate as a facilitator during a public meeting concerning natural resource management.*

Measurement Criteria: *Lead a group habitat conservation project.*

Measurement Criteria: *Volunteer in a natural resource area.*

Performance Element: Personally interpret natural resource phenomena to natural resource users.

Measurement Criteria: *Lead a group hike to interpret a natural area.*

Measurement Criteria: *Conduct a workshop, activity or program to interpret an example of natural resource conservation.*

Measurement Criteria: *Develop an interpretive trail to describe a natural resource area.*

Measurement Criteria: *Produce printed material that interprets a natural resource area or phenomenon.*

Measurement Criteria: *Produce natural resource curriculum materials.*

Measurement Criteria: *Develop a sign to communicate a natural resource area or phenomenon.*

Measurement Criteria: *Create a multi-media/video presentation that interprets a natural resource topic, area or phenomenon.*

Measurement Criteria: *Create a web page to present and interpret a natural resource topic, area or phenomenon.*

Pathway KS Statement: Apply scientific principles to natural resource management activities.

Performance Element: Use science concepts, processes, and research techniques to examine natural resource topics.

Measurement Criteria: *Develop a research/monitoring plan to inquire about a natural resource topic.*

Measurement Criteria: *Conduct a research/monitoring activity for a natural resource topic.*

Measurement Criteria: *Evaluate the results of a natural resource-related inquiry.*

Measurement Criteria: *Produce a technical report of results/findings.*

Pathway Topic: Natural Resource Systems Topics

Performance Element: Examine biological and physical characteristics to identify and classify natural resources.

Measurement Criteria: *Identify tree species and other woody vegetation.*
Measurement Criteria: *Identify grass and forb species.*
Measurement Criteria: *Identify wildlife species.*
Measurement Criteria: *Identify fish species.*
Measurement Criteria: *Identify rocks, minerals and soil types.*

Performance Element: Examine natural cycles and related phenomena to describe ecologic concepts and principles.

Measurement Criteria: *Describe the hydrologic cycle.*
Measurement Criteria: *Describe the nitrogen cycle.*
Measurement Criteria: *Describe the carbon cycle.*
Measurement Criteria: *Describe nutrient cycles.*
Measurement Criteria: *Describe succession.*
Measurement Criteria: *Describe population dynamics.*
Measurement Criteria: *Describe primary and secondary producers.*
Measurement Criteria: *Describe predator-prey relationships.*
Measurement Criteria: *Identify potential pollution sources.*
Measurement Criteria: *Define watershed boundaries.*
Measurement Criteria: *Use stream classification system.*
Measurement Criteria: *Describe the influence of weather and climatic factors.*

Pathway KS Statement: Employ knowledge of natural resource industries to describe production practices and processing procedures.

Performance Element: Prepare presentations to describe how natural resource products are produced, harvested, processed and used.

Measurement Criteria: *Describe forest harvest techniques and procedures.*
Measurement Criteria: *Describe wildlife harvest techniques and procedures.*
Measurement Criteria: *Describe fish harvest techniques and procedures.*
Measurement Criteria: *Describe how minerals and ores are extracted and processed.*
Measurement Criteria: *Describe how oil is extracted and processed.*
Measurement Criteria: *Describe hydroelectric generation techniques and procedures.*
Measurement Criteria: *Describe how public recreation use is a product.*

Pathway KS Statement: Practice responsible conduct to protect natural resources.

Performance Element: Employ techniques and equipment needed to prevent wildfire.

Measurement Criteria: *Demonstrate personal fire prevention precautions while working in natural environments.*
Measurement Criteria: *Participate in wildfire prevention community service project.*

Performance Element: Use wildfire suppression techniques to demonstrate abilities in firefighting and control.

Measurement Criteria: *Meet industry standards for fire suppression training (e.g., National Wildfire Coordinating Group Firefighter Certification Standards).*

Pathway Topic: Natural Resource Systems Topics

Performance Element: Recognize symptoms of animal and plant diseases and use appropriate techniques to prevent their spread.

Measurement Criteria: *Identify observable diseases impacting plants and animals.*

Measurement Criteria: *Describe how to report observance of disease infestations.*

Measurement Criteria: *Use appropriate techniques and equipment when working with bio-hazards.*

Performance Element: Recognize insect types and available controls to prevent insect infestation.

Measurement Criteria: *Identify and classify insects.*

Measurement Criteria: *Identify insect damage signs.*

Measurement Criteria: *Describe how to report observance of insect infestation.*

Performance Element: Use acceptable pesticides to treat insect infestation.

Measurement Criteria: *Obtain appropriate pesticide applicators' license.*

Measurement Criteria: *Apply materials to treat for insect infestation.*

Performance Element: Know law enforcement procedures to manage public gatherings and to gain entry into secure, closed or restricted areas.

Measurement Criteria: *Demonstrate precautions to use when interfacing with the public concerning regulations and law enforcement.*

Measurement Criteria: *Describe security issues for closed and restricted areas.*

Measurement Criteria: *Describe solutions to issues concerning public protection.*

Measurement Criteria: *Recognize potential threat situations for the public and other resource users.*

Measurement Criteria: *Identify the appropriate law enforcement authority.*

PATHWAY: Environmental Service Systems

Pathway Topic: Environmental Service Systems Topics

Pathway KS Statement: Use analysis procedures to plan and evaluate environmental service impacts.

Performance Element: Use instrumentation to monitor samples.

Measurement Criteria: *Operate basic laboratory equipment and environment monitoring instruments (e.g., pH meter/ISE meter, compound microscope/dissecting microscope, sound level measuring devices, turbidimeter, conductivity meter, chlorine meter OVA, HNMU).*

Measurement Criteria: *Perform chemical laboratory sample preparation.*

Measurement Criteria: *Perform analytical separation techniques.*

Measurement Criteria: *Perform spectroscopic analysis using instruments such as: spectrophotometer/auto spectrophotometer, AA/graphite furnace, ICP, GC/MS, oxygen meter, IC, IR, FTIR X-ray diffraction nitrogen analyzer, mercury analyzer, FID/PID analyzer, and RAD meter.*

Measurement Criteria: *Operate advanced laboratory and field equipment and instruments (e.g., HPLC, GC, bomb calorimeter, geiger mueller counter, explosimeters specific gas meters, carbon analyzer, microwave).*

Measurement Criteria: *Use computers to interface with chemical analytical instruments.*

Measurement Criteria: *Perform instrumental analysis (e.g., mass spectrometers, chromatographs, electron microscopes).*

Performance Element: Calibrate and service instruments on a timely schedule to maintain environmental instrumentation.

Measurement Criteria: *Maintain instruments using gas systems.*

Measurement Criteria: *Calibrate chemical analytical instruments.*

Measurement Criteria: *Operate and maintain flow instrument systems.*

Measurement Criteria: *Operate and maintain pressure test instruments (e.g., manometers, vacuum pumps, pressure and vacuum gages).*

Measurement Criteria: *Service thermal measuring instruments.*

Measurement Criteria: *Service physical property (e.g., sample control) measuring instruments.*

Measurement Criteria: *Service chemical property measuring instruments (e.g., O2 meter, spectrophotometer, atomic absorption spectrophotometer, inductively coupled plasma, ion chromatography, infrared).*

Performance Element: Apply statistics, charts, and scattergrams to measure and monitor operations.

Measurement Criteria: *Apply basic statistics concepts.*

Measurement Criteria: *Interpret scattergrams.*

Measurement Criteria: *Analyze probability theories.*

Measurement Criteria: *Determine control limits.*

Measurement Criteria: *Determine process capability.*

Pathway Topic: Environmental Service Systems Topics

Measurement Criteria: *Prepare and evaluate charts.*

Measurement Criteria: *Conduct process improvement studies.*

Measurement Criteria: *Interpret quantitative and graphic output from chemical analysis instruments.*

Pathway KS Statement: Identify public policies and regulations impacting environmental services to determine their effect on facility operation.

Performance Element: Consult reliable resources or training to identify the major laws impacting environmental services.

Measurement Criteria: *Identify key components of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).*

Measurement Criteria: *Identify requirements of Superfund Amendment Reauthorization Act (SARA).*

Measurement Criteria: *Identify requirements of waste and material transportation.*

Measurement Criteria: *Describe job-related activities subject to the Occupational Safety and Health Administration (OSHA).*

Measurement Criteria: *Describe requirements of Resource Conservation and Recovery Act (RCRA).*

Measurement Criteria: *Explain requirements of Clean Water Act.*

Measurement Criteria: *Explain requirements of Safe Drinking Water Act (SDWA).*

Measurement Criteria: *Explain requirements of Clean Air Act.*

Measurement Criteria: *Identify requirements of the Nuclear Waste Policy Act.*

Measurement Criteria: *Identify key components of (_____)ISO 14000.*

Pathway KS Statement: Apply scientific principles to environmental services.

Performance Element: Apply meteorological knowledge to recognize weather systems and weather patterns.

Measurement Criteria: *Identify the components of the earth's atmosphere.*

Measurement Criteria: *Explain basic meteorology principles.*

Performance Element: Describe soil compositions and properties to demonstrate knowledge of soil science.

Measurement Criteria: *Describe soil geology.*

Measurement Criteria: *Describe composition of soil.*

Measurement Criteria: *Describe the biological properties of soil.*

Measurement Criteria: *Identify the physical properties of soil.*

Measurement Criteria: *Describe the chemical properties of soil.*

Measurement Criteria: *Test soil samples to determine characteristics.*

Measurement Criteria: *Explain classification of soil water.*

Measurement Criteria: *Explain the relationship between soil classifications and land use.*

Performance Element: Explain well design and groundwater supplies to demonstrate knowledge of hydrology.

Measurement Criteria: *Explain hydrology.*

Measurement Criteria: *Explain geological and meteorological principles affecting groundwater supply.*

Pathway Topic: Environmental Service Systems Topics

Measurement Criteria: *Conduct channel flow analysis.*

Measurement Criteria: *Identify basic criteria for water well design.*

Measurement Criteria: *Identify differences in groundwater potential.*

Measurement Criteria: *Identify environmental hazards associated with groundwater supplies.*

Performance Element: Discuss properties, classifications and functions in order to understand wetland principles.

Measurement Criteria: *Explain wetlands classification.*

Measurement Criteria: *Explain the function of wetlands.*

Measurement Criteria: *Describe the living components of wetland habitats.*

Measurement Criteria: *Delineate wetlands.*

Measurement Criteria: *Identify techniques used in wetland management, enhancement and restoration programs.*

Measurement Criteria: *Identify principles used in wetland mitigation and restoration.*

Performance Element: Discuss properties, classifications and functions in order to understand watershed principles.

Measurement Criteria: *Identify properties of watersheds.*

Measurement Criteria: *Explain watershed management.*

Measurement Criteria: *Delineate watersheds.*

Measurement Criteria: *Assess source water.*

Performance Element: Use chemical analysis to conduct tests.

Measurement Criteria: *Explain basic chemistry principles (e.g., elements, compounds).*

Measurement Criteria: *Apply chemical laboratory skills.*

Performance Element: Perform common microbiology procedures to examine cell types and conduct tests.

Measurement Criteria: *Conduct bioassay tests.*

Measurement Criteria: *Identify groups of microorganisms.*

Measurement Criteria: *Analyze factors affecting microbial growth.*

Performance Element: Apply sampling techniques and other assessments to demonstrate background knowledge of microbiology.

Measurement Criteria: *Apply microbiological principles and procedures.*

Measurement Criteria: *Explain immunological procedures.*

Measurement Criteria: *Describe roles of microorganisms in the environment.*

Measurement Criteria: *Explain microbial growth.*

Measurement Criteria: *Describe influence of environmental factors on microbes.*

Measurement Criteria: *Demonstrate the use of fundamental statistics in sampling practices.*

Pathway KS Statement: Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.

Performance Element: Use pollution control measures to maintain a safe facility environment.

Measurement Criteria: *Identify types of pollution (e.g., ground, surface water, air,*

Pathway Topic: Environmental Service Systems Topics

noise, radioactive contamination).

Measurement Criteria: *Identify presence of pollution.*

Measurement Criteria: *Describe environmental impact from industrial and non-industrial processes.*

Measurement Criteria: *Quantify extent of pollution.*

Measurement Criteria: *Locate and monitor sources of pollution.*

Measurement Criteria: *Conduct remediation activities.*

Measurement Criteria: *Monitor remediation activities.*

Measurement Criteria: *Establish pollution management and prevention program.*

Performance Element: Apply principles of solid waste management (landfill) to manage safe disposal of all categories of waste.

Measurement Criteria: *Collect solid waste materials.*

Measurement Criteria: *Treat solid waste materials.*

Measurement Criteria: *Manage solid waste systems.*

Measurement Criteria: *Identify characteristics of solid waste treatment.*

Measurement Criteria: *Identify the risks associated with solid waste accumulation and disposal.*

Measurement Criteria: *Describe methods of site identification and acceptance.*

Measurement Criteria: *Explain sanitary landfill operating procedures.*

Measurement Criteria: *Monitor sanitary landfill procedures.*

Measurement Criteria: *Describe methods to operate a composting facility.*

Measurement Criteria: *Describe methods to incinerate solid waste.*

Measurement Criteria: *Describe recycling methods.*

Performance Element: Apply drinking water treatment operations principles to assure safe water at a facility.

Measurement Criteria: *Identify characteristics of drinking water treatment.*

Measurement Criteria: *Explain the aeration process in water treatment.*

Measurement Criteria: *Monitor the mixing, coagulation and flocculation processes in water treatment.*

Measurement Criteria: *Monitor the filtration and sedimentation process in water treatment.*

Measurement Criteria: *Monitor the water-softening process in water treatment.*

Measurement Criteria: *Monitor the stabilization process in water treatment.*

Measurement Criteria: *Monitor the corrosion-control process in water treatment.*

Measurement Criteria: *Monitor the disinfection process in water treatment.*

Measurement Criteria: *Monitor the iron and manganese removal processes in water treatment.*

Measurement Criteria: *Describe taste and odor control in water treatment.*

Measurement Criteria: *Describe the demineralization processes in water treatment.*

Measurement Criteria: *Monitor the fluoridation process in water treatment.*

Measurement Criteria: *Identify facility operational problems in water treatment.*

Measurement Criteria: *Identify methods for backflow prevention.*

Performance Element: Apply wastewater treatment operations principles to manage wastewater disposal in keeping with rules and regulations.

Pathway Topic: Environmental Service Systems Topics

Measurement Criteria: *Identify characteristics of wastewater treatment.*

Measurement Criteria: *Sample wastewater.*

Measurement Criteria: *Describe wastewater collection systems.*

Measurement Criteria: *Analyze the constituents of wastewater entering wastewater treatment facility.*

Measurement Criteria: *Describe the mixing, coagulation and flocculation processes in wastewater treatment.*

Measurement Criteria: *Describe the disinfection process in wastewater treatment.*

Measurement Criteria: *Describe the treatment train, effluent disposal, and biosolids management in wastewater.*

Measurement Criteria: *Analyze process optimization for the treatment train, effluent disposal, and biosolids management in wastewater treatment.*

Measurement Criteria: *Analyze treatment process control for the treatment train, effluent disposal, and biosolids management in wastewater.*

Measurement Criteria: *Inspect and maintain equipment for the treatment train, effluent disposal, and biosolids management in wastewater.*

Measurement Criteria: *Describe common facility operational problems.*

Measurement Criteria: *Identify methods for cross-connection and backflow prevention.*

Performance Element: Apply hazardous materials management principles to assure a safe facility and to comply with applicable regulations.

Measurement Criteria: *Describe risks related to hazardous materials.*

Measurement Criteria: *Describe health and safety practices to reduce risks from hazardous materials.*

Measurement Criteria: *Demonstrate appropriate responses for major types of hazardous materials disasters (e.g., chemical, fire and explosion, general safety hazards) (FRA, FRO, HMT, HMS).*

Measurement Criteria: *Describe appropriate use of Personal Protective Equipment (PPE).*

Measurement Criteria: *Explain hazardous substance regulations.*

Measurement Criteria: *Demonstrate ability to obtain and use information addressing hazardous substance release.*

Measurement Criteria: *Demonstrate safe handling procedures for hazardous materials and hazardous waste.*

Measurement Criteria: *Evaluate laboratory results.*

Measurement Criteria: *Demonstrate methods for identifying hazardous material.*

Measurement Criteria: *Detect hazardous materials.*

Measurement Criteria: *Perform site evaluation for hazardous material risk.*

Measurement Criteria: *Retrieve and evaluate hazardous materials and hazardous waste sample data.*

Measurement Criteria: *Respond to mock hazardous materials emergency situations.*

Measurement Criteria: *Describe use of equipment related to hazardous materials and hazardous-waste operations.*

Measurement Criteria: *Prepare hazardous materials for transportation and storage in accordance with regulations.*

Measurement Criteria: *Demonstrate ability to operate treatment and disposal systems*

Pathway Topic: Environmental Service Systems Topics

for hazardous materials and hazardous waste.

Measurement Criteria: *Maintain required documents for hazardous-materials and hazardous-waste management activities.*

Measurement Criteria: *Audit regulatory compliance.*

Performance Element: Explore conventional and alternative supplies to define energy sources.

Measurement Criteria: *Identify conventional energy sources and their environmental impact.*

Measurement Criteria: *Identify alternate energy sources and their environmental impact.*

Pathway KS Statement: Use tools, equipment, machinery and technology to accomplish tasks in environmental services.

Performance Element: Use technological tools to map land, facilities, and infrastructure.

Measurement Criteria: *Apply surveying and mapping principles to make site measurements and map facility accesses and infrastructure.*

Measurement Criteria: *Apply basic drafting skills to create working drawings.*

Measurement Criteria: *Use CADD fundamentals to create specialized documents.*

Measurement Criteria: *Apply cartographic skills.*

Measurement Criteria: *Apply surveying skills.*

Measurement Criteria: *Use geo-spatial analysis processes for an environmental services application.*

PATHWAY: Agribusiness Systems

Pathway Topic: Agribusiness Systems Topic

Pathway KS Statement: Employ leadership skills to accomplish goals and objectives in an AFNR business environment.

Performance Element: Develop a mission statement to guide business activities effectively.

Measurement Criteria: *Identify planning approaches for preparing mission statement.*

Measurement Criteria: *Write a mission statement.*

Measurement Criteria: *Establish short- and long-term goals.*

Measurement Criteria: *Ask for feedback from stakeholders to test the impact of the mission statement.*

Measurement Criteria: *Disseminate mission statement to inform fellow employees and gain*
Disseminate mission statement to inform fellow employees and gain
in-house support.

Performance Element: Apply leadership skills to accomplish general business activities from production to public relations.

Measurement Criteria: *Identify leadership styles.*

Measurement Criteria: *Conduct a business meeting using proper parliamentary procedures/consensus techniques.*

Measurement Criteria: *Work in teams to access a variety of expertise.*

Measurement Criteria: *Extend a pat on the back for jobs well done.*

Performance Element: Apply management skills to accomplish general business activities from production to public relations.

Measurement Criteria: *Identify management types.*

Measurement Criteria: *Identify organizational structures.*

Measurement Criteria: *Identify time management techniques.*

Measurement Criteria: *Make business agreements.*

Measurement Criteria: *Follow local, state, and federal regulations and appreciate the consequences of not following them.*

Measurement Criteria: *Recruit, train and evaluate human resources.*

Measurement Criteria: *Make business presentations.*

Pathway KS Statement: Practice good record keeping to accomplish AFNR business objectives.

Performance Element: Prepare and maintain all files as needed to accomplish effective record keeping.

Measurement Criteria: *Identify information management systems.*

Measurement Criteria: *Develop record keeping techniques and practices.*

Measurement Criteria: *Keep production and agribusiness records.*

Measurement Criteria: *Make records analysis.*

Pathway KS Statement: Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.

Pathway Topic: Agribusiness Systems Topic

Performance Element: Use key accounting fundamentals to accomplish dependable bookkeeping and associated files.

Measurement Criteria: *Budget resources (e.g., capital, human, financial, time).*

Measurement Criteria: *Manage assets for optimum utilization.*

Measurement Criteria: *Manage risk of liabilities.*

Measurement Criteria: *Evaluate credit uses and options.*

Measurement Criteria: *Prepare and interpret financial statements (e.g., balance sheet, profit/loss statement, cash flow statement).*

Measurement Criteria: *Prepare tax forms (e.g., W-4, I9, Depreciation, 1099, Workers Compensation).*

Measurement Criteria: *Determine cost of doing business.*

Measurement Criteria: *Compare and examine advantages and disadvantages of banking procedures (e.g., bank reconciliation).*

Measurement Criteria: *Analyze investment options (e.g., buy, lease, finance, risk).*

Pathway KS Statement: Employ AFNR industry concepts and practices to manage inventory.

Performance Element: Monitor inventory levels to accomplish practical inventory control.

Measurement Criteria: *Maintain optimum inventory levels.*

Measurement Criteria: *Apply just-in-time concepts.*

Measurement Criteria: *Calculate costs of carrying inventory.*

Measurement Criteria: *Perform logistics management.*

Pathway KS Statement: Utilize technology to accomplish AFNR business objectives.

Performance Element: Use technology and information technology strategies for business improvement.

Measurement Criteria: *Utilize leading technology; e.g., Global Positioning System (GPS), Geographical Information System (GIS), Personal Data Application (PDA), cellular.*

Measurement Criteria: *Create and use documents using word processors, spreadsheets, databases and electronic mail.*

Measurement Criteria: *Conduct research using the Internet.*

Measurement Criteria: *Conduct oral/visual presentation using presentation software.*

Pathway KS Statement: Use sales and marketing principles to accomplish an AFNR business objective.

Performance Element: Conduct market research.

Measurement Criteria: *Evaluate methods of marketing products and services.*

Measurement Criteria: *Apply economic principles to marketing (e.g., supply and demand).*

Measurement Criteria: *Research products and service design(s).*

Performance Element: Develop a marketing plan.

Measurement Criteria: *Identify and develop value-added products.*

Measurement Criteria: *Develop public relations campaigns.*

Pathway Topic: Agribusiness Systems Topic

Measurement Criteria: *Develop sales goals and incentive programs.*

Performance Element: Implement a marketing plan.

Measurement Criteria: *Promote products and services.*

Measurement Criteria: *Advertise products and services.*

Performance Element: Merchandise products and services.

Measurement Criteria: *Identify key components to organize a sale.*

Measurement Criteria: *Build and develop customer relationships.*

Measurement Criteria: *Conduct sales presentation.*

Measurement Criteria: *Provide post-sale service.*

Measurement Criteria: *Handle customer complaints.*

Measurement Criteria: *Locate prospective new customers.*

Section IV – O*NET Crosswalk Report

Career Specialty/ Occupational Coding and Crosswalk

Summary

The objective of the Career Specialty/ Occupational Coding and Crosswalk project is to accomplish two basic tasks. The first is to design and establish a classification and coding structure for the States' Career Clusters Initiative. When completed, the classification and coding structure will be compatible with existing occupational classification systems and designed in a manner that allows for easy updating and the flexibility to add additional career pathways and occupational specialties.

Once the first step is completed for each cluster, the second step is to build a linkage system or crosswalk between the new career cluster classification system and the O*NET occupational classification system developed and operated by the U S Department of Labor. O*NET is a nationally recognized taxonomy with detailed descriptions and a rich database of information for each occupation.

Explanation of Crosswalk Table

The attached table lists each occupational specialty and its related O*NET occupation. It is sequenced by career pathway and occupational specialty code. It should be noted that the relationship between an occupational specialty and its related O*NET occupation is often not one-to-one. The O*NET occupation is often much broader covering two or more occupational specialties. In fact, even when multiple occupational specialties are assigned, they may only represent a part of a broader O*NET occupation.

Column 1: Lists occupational specialties that were identified by the Career Clusters Initiative. The occupational specialties are organized by cluster pathways and represent occupational titles with no definitions. They are intended to be a sample of occupations that help define the cluster and pathway.

Column 2: Represents related occupations from the O*NET occupational coding system.

Note: A crosswalk from the occupational specialties to the Classification of Instructional Programs (CIP) codes is forthcoming. The National Crosswalk Service Center is currently developing the CIP to O*NET crosswalk which will be the bridge to the career cluster occupational specialties. You may access this crosswalk in the near future at: http://www.xwalkcenter.org/

Agriculture, Food and Natural Resources Career Cluster: Occupational Specialties and Related O*NET Occupations, Sequenced by Career Pathways and Occupational Specialty Codes

Occupational Specialty		Related SOC/O*NET Occupation	
Code	**Title**	**Code**	**Title**
1.10000	**Food Products and Processing Systems Pathway**		
1.10010	Agricultural Sales	41-4011.01	Sales Representatives, Agricultural
1.10020	Agricultural Communications Specialists	99-0000.00	No comparable O*NET occupation
1.10030	Business-Educators	25-1011.00	Business Teachers, Postsecondary
1.10040	Food Scientists	19-1012.00	Food Scientists and Technologists
1.10050	Meat Processors-Toxicologists	19-1042.00	Medical Scientists, Except Epidemiologists
1.10050	Meat Processors-Toxicologists	51-3021.00	Butchers and Meat Cutters
1.10050	Meat Processors-Toxicologists	51-3022.00	Meat, Poultry, and Fish Cutters and Trimmers
1.10050	Meat Processors-Toxicologists	51-3023.00	Slaughterers and Meat Packers
1.10050	Meat Processors-Toxicologists	51-3091.00	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders
1.10050	Meat Processors-Toxicologists	51-3092.00	Food Batchmakers
1.10050	Meat Processors-Toxicologists	51-3093.00	Food Cooking Machine Operators and Tenders
1.10060	Biochemists-Nutritionists-Dieticians	19-1021.01	Biochemists
1.10060	Biochemists-Nutritionists-Dieticians	29-1031.00	Dietitians and Nutritionists
1.10070	Food Brokers-Food Inspectors	13-1021.00	Purchasing Agents and Buyers, Farm Products
1.10070	Food Brokers-Food Inspectors	45-2011.00	Agricultural Inspectors
1.10080	Meat Cutters-Meat Graders	45-2011.00	Agricultural Inspectors
1.10080	Meat Cutters-Meat Graders	51-3021.00	Butchers and Meat Cutters
1.10080	Meat Cutters-Meat Graders	51-3022.00	Meat, Poultry, and Fish Cutters and Trimmers
1.10090	Meat Science Researchers	19-1012.00	Food Scientists and Technologists
1.10100	Food Meal Supervisors	45-1011.02	First-Line Supervisors and Manager/Supervisors - Animal Husbandry Workers
1.10110	Cheese Makers	51-3092.00	Food Batchmakers
1.10120	Microbiologists	19-1022.00	Microbiologists
1.10130	Produce Buyers	13-1021.00	Purchasing Agents and Buyers, Farm Products
1.10140	Bacteriologists	19-1022.00	Microbiologists
1.10150	Food and Drug Inspectors	45-2011.00	Agricultural Inspectors
1.10160	Bioengineers	17-2081.00	Environmental Engineers
1.10170	Biochemists	19-1021.01	Biochemists
1.10180	Food and Fiber Engineers	17-2021.00	Agricultural Engineers
1.10190	Food Processors	51-3091.00	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders

Agriculture, Food and Natural Resources Career Cluster: Occupational Specialties and Related O*NET Occupations, Sequenced by Career Pathways and Occupational Specialty Codes

Occupational Specialty		Related SOC/O*NET Occupation	
Code	**Title**	**Code**	**Title**
1.10190	Food Processors	51-3092.00	Food Batchmakers
1.10190	Food Processors	51-3093.00	Food Cooking Machine Operators and Tenders
1.10200	Storage Supervisors	53-1000.00	Supervisors, Transportation and Material Moving Workers
1.10210	Fieldman	41-4011.01	Sales Representatives, Agricultural
1.10220	Quality Control Specialists	17-2112.00	Industrial Engineers
1.20000	**Plant Systems Pathway**		
1.20010	Bioinformatics Specialists	19-1022.00	Microbiologists
1.20020	Plant Breeders and Geneticists	19-1013.01	Plant Scientists
1.20030	Biotechnology Lab Technician	19-4021.00	Biological Technicians
1.20040	Soil and Water Specialists	19-4093.00	Forest and Conservation Technicians
1.20050	Crop Farm Managers	11-9011.00	Farm, Ranch, and Other Agricultural Managers
1.20060	Agricultural Educators	25-1041.00	Agricultural Sciences Teachers, Postsecondary
1.20070	Plant Pathologists	19-1013.01	Plant Scientists
1.20080	Aquaculturalists	19-1013.00	Soil and Plant Scientists
1.20090	Sales Representatives	41-4011.01	Sales Representatives, Agricultural
1.20100	Botanists	19-1020.00	Biological Scientist
1.20110	Tree Surgeons	37-3013.00	Tree Trimmers and Pruners
1.20120	Education and Extension Specialists	25-9021.00	Farm and Home Management Advisors
1.20130	Ag Lenders	13-2072.00	Loan Officers
1.20140	Agricultural Journalists	27.3022.01	Reporters and Correspondents
1.20150	Commodity Marketing Specialists	41-3031.01	Sales Agents, Securities and Commodities
1.20160	Grain Operations Superintendents	11-3071.00	Transportation, Storage, and Distribution Managers
1.20160	Grain Operations Superintendents	51-1011.00	First-Line Supervisors/Managers of Production and Operating Workers
1.20170	Custom Hay/Silage Operators	45-2093.00	Farmworkers, Farm and Ranch Animals
1.20180	Forest Genetisists	19-1032.00	Foresters
1.20190	Golf Course Superintendents	11-9199.00	Managers, All Other
1.20190	Golf Course Superintendents	37-1012.02	First-Line Supervisors and Manager/Supervisors - Landscaping Workers
1.20200	Greenhouse Managers	11-9011.01	Nursery and Greenhouse Managers
1.20210	Growers	11-9011.02	Agricultural Crop Farm Managers
1.20220	Farmers	11-9012.00	Farmers and Ranchers

Agriculture, Food and Natural Resources Career Cluster: Occupational Specialties and Related O*NET Occupations, Sequenced by Career Pathways and Occupational Specialty Codes

Occupational Specialty		Related SOC/O*NET Occupation	
Code	**Title**	**Code**	**Title**
1.20230	Ranchers	11-9012.00	Farmers and Ranchers
1.30000	**Animal Systems Pathway**		
1.30010	Agricultural Educators	25-1041.00	Agricultural Sciences Teachers, Postsecondary
1.30020	Livestock producers	45-2021.00	Animal Breeders
1.30030	AI Technicians-Aquaculturalists	45-2093.00	Farmworkers, Farm and Ranch Animals
1.30040	Animal Caretakers-Poultry Managers	11-9011.00	Farm, Ranch, and Other Agricultural Managers
1.30050	Equine Managers-Veterinarians	19-1011.00	Animal Scientists
1.30050	Equine Managers-Veterinarians	29-1131.00	Veterinarians
1.30060	Veterinary Assistants-Feedlot Specialists	31-9096.00	Veterinary Assistants and Laboratory Animal Caretakers
1.30070	Animal Scientists	19-1011.00	Animal Scientists
1.30080	Embryo Technologists	29-2056.00	Veterinary Technologists and Technicians
1.30090	Livestock Buyers	13-1021.00	Purchasing Agents and Buyers, Farm Products
1.30100	Feed Sales Representatives	41-4011.01	Sales Representatives, Agricultural
1.30110	Wildlife Biologists	19-1023.00	Zoologists and Wildlife Biologists
1.30120	Livestock Geneticists	19-1023.00	Zoologists and Wildlife Biologists
1.30130	Animal Nutritionists	19-1011.00	Animal Scientists
1.30140	Dairy Producers	11-9012.00	Farmers and Ranchers
1.30150	Livestock Inspectors	45-2011.00	Agricultural Inspectors
1.30160	Feed Sales Specialists	41-4011.01	Sales Representatives, Agricultural
1.30170	Animal Health Salespersons	41-3099.00	Sales Representatives, Services, All Other
1.30180	Animal Health Salespersons	41-3099.00	Sales Representatives, Services, All Other
1.30190	Meat Science Researcher	19-1011.00	Animal Scientists
1.30200	Reproductive Physiologists	19-1029.00	Biological Scientists, All Other
1.30210	Embryo Transfer Technicians	29-2056.00	Veterinary Technologists and Technicians
1.30220	Pet Shop Operators	39-2021.00	Nonfarm Animal Caretakers
1.30220	Pet Shop Operators	41-1011.00	First-Line Supervisors/Managers of Retail Sales Workers
1.30230	USDA Inspectors	45-2011.00	Agricultural Inspectors
1.40000	**Power Structural and Technical Systems Pathway**		
1.40010	Machine Operators	45-2091.00	Agricultural Equipment Operators
1.40020	Electronics Systems Technicians	17-3023.01	Electrical and Electronic Engineering Technicians

Agriculture, Food and Natural Resources Career Cluster: Occupational Specialties and Related O*NET Occupations, Sequenced by Career Pathways and Occupational Specialty Codes

Occupational Specialty		Related SOC/O*NET Occupation	
Code	**Title**	**Code**	**Title**
1.40030	Agricultural Engineers	25-1041.00	Agricultural Sciences Teachers, Postsecondary
1.40040	Agricultural Extension Engineering Specialists	25-9021.00	Farm and Home Management Advisors
1.40050	Heavy Equipment Maintenance Technicians	49-3042.00	Mobile Heavy Equipment Mechanics, Except Engines
1.40060	Recycling Technicians	19-4091.00	Environmental Science and Protection Technicians, Including Health
1.40070	Waste Water Treatment Plant Operators	51-8031.00	Water and Liquid Waste Treatment Plant and System Operators
1.40080	Equipment/Parts Managers	41-2022.00	Parts Salespersons
1.40090	Welders	51-4121.02	Welders and Cutters
1.40090	Welders	51-4121.03	Welder-Fitters
1.40100	Machinists	51-4041.00	Machinists
1.40110	Communication Technicians	27-4010.00	Broadcast and Sound Engineering Technicians and Radio Operators
1.40110	Communication Technicians	27-4011.00	Audio and Video Equipment Technicians
1.40110	Communication Technicians	27-4012.00	Broadcast Technicians
1.40110	Communication Technicians	27-4014.00	Sound Engineering Technicians
1.40120	Agricultural Applications Software Developers/Programmers	15-1051,00	Computer Systems Analysts
1.40130	Database Administrators	15-1061.00	Database Administrators
1.40140	Computer Service Technical Support Technicians	15-1041.00	Computer Support Specialists
1.40150	Information Lab Specialists	15-1041.00	Computer Support Specialists
1.40160	GPS Technicians	99-0000.00	Not enough information
1.40170	Remote Sensing Specialists	19-4041.01	Geological Data Technicians
1.50000	**Natural Resources Systems Pathway**		
1.50010	Cartographers	17-1021.00	Cartographers and Photogrammetrists
1.50020	Wildlife Managers	11-9121.00	Natural Sciences Managers
1.50030	Range Technicians	19-1031.02	Range Managers
1.50030	Range Technicians	19-4093.00	Forest and Conservation Technicians
1.50040	Ecologists	19-2041.00	Environmental Scientists and Specialists, Including Health
1.50050	Park Managers	11-1021.00	General and Operations Managers
1.50060	Youth Program Director	11-9151.00	Social and Community Service Managers
1.50070	Fish and Game Officers	33-3031.00	Fish and Game Wardens

Agriculture, Food and Natural Resources Career Cluster: Occupational Specialties and Related O*NET Occupations, Sequenced by Career Pathways and Occupational Specialty Codes

Occupational Specialty		Related SOC/O*NET Occupation	
Code	**Title**	**Code**	**Title**
1.50080	Loggers	45-4021.00	Fallers
1.50080	Loggers	45-4022.00	Logging Equipment Operators
1.50080	Loggers	45-4022.01	Logging Tractor Operators
1.50090	Forest Technicians	19-4093.00	Forest and Conservation Technicians
1.50100	Log Graders	45-4023.00	Log Graders and Scalers
1.50110	Pulp and Paper Manager	11-3051.00	Industrial Production Managers
1.50120	Soil Geology Technician	19-4041.02	Geological Sample Test Technicians
1.50130	Geologists	19-2042.01	Geologists
1.50140	Mining Engineers	17-2151.00	Mining and Geological Engineers, Including Mining Safety Engineers
1.50150	Fisheries Technicians	19-4021.00	Biological Technicians
1.50160	Water Monitoring Technician	19-4091.00	Environmental Science and Protection Technicians, Including Health
1.50170	Hydrologists	19-2043.00	Hydrologists
1.50180	Fish Hatchery Manager	11-9011.03	Fish Hatchery Managers
1.50190	Heavy Equipment Operator	53-7032.01	Excavating and Loading Machine Operators
1.50190	Heavy Equipment Operator	47-2073.02	Operating Engineers
1.50200	Solid Waste Disposal Managers	11-3071.00	Transportation, Storage, and Distribution Managers
1.50210	Hazardous Materials Technicians	47-4041.00	Hazardous Materials Removal Workers
1.50220	Toxicologists	19-1042.00	Medical Scientists, Except Epidemiologists
1.50230	Environmentalists	19-2041.00	Environmental Scientists and Specialists, Including Health
1.50240	Commercial Fishermen	45-3011.00	Fishers and Related Fishing Workers
1.50250	Fishing Vessel Operators	45-3011.00	Fishers and Related Fishing Workers
1.50260	Vessel Crew	53-5011.01	Able Seamen
1.50260	Vessel Crew	53-5011.02	Ordinary Seamen and Marine Oilers

Section V – Cluster Profile
Advisory Committee List

Career Cluster Profile

Cluster Name: Agriculture, Food and Natural Resources

Project Lead States: Idaho and Iowa

Project Lead State Contact Information:

Richard Ledington, Project Director
Idaho Division of Professional Technical Education
650 W State Street, Room 324 P O Box 83720
Boise, ID 83720-0095
PH: (208) 334-3216
Email: dledingt@pte.state.id.us

Michael Rush, State Director
Idaho Division of Professional Technical Education
650 W State Street, Room 324
Boise, ID 83720-0095
PH: (208) 334-3216 Email: mrush@pte.state.id.us

Dale Gruis, Project Director
Iowa Department of Education
Grimes State Office Bldg
Des Moines, IA 503190146
PH: (515) 281-4712
Email: dale.gruis@ed.state.ia.us

Janice Nahra-Friedel
Administrator
Iowa Department of Education
East 14th & Grand Avenue
Grimes State Office Building
Des Moines, IA 50319-0146
Email: Janice.friedel@ed.state.ia.us

Cluster Coordinators: Curtis Shumaker and Larry Case

Cluster Definition: The production, processing, marketing, financing, and development of agriculture commodities and resources including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/services.

Cluster Pathways: 1) Food Products and Processing Systems; 2) Plant Systems; 3) Animal Systems; 4) Power, Structural & Technical Systems; 5) Natural Resources Systems; 6) Environmental Service Systems; 7) Agribusiness Systems.

Cluster Partners: List attached.

Number of cluster partners in each of the following categories:

Postsecondary Education:	12
Secondary Education:	7
Business & Industry	40
Labor	1
Associations	6
Government Agencies	24

Deliverable #1: Agriculture, Food & Natural Resources Cluster Advisory Committee Members

Names of the Executive Committee Members are indicated in bold

Updated: August 23, 2002

Name	Organization/ Company/School	Address	City	State, ZIP	Phone	E-mail	Pathway
Agler, Clell	Buckeye Building Systems	PO Box 682	Grove City	OH 43123	614-296-3385		
Alvey, Mary	Oregon Division of Health	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		Mary.b.alvey@state.or.us	Environmental Service Systems
Besancon, Gary	Agri Mark	PO Box 215, 686 E. Main St.	Smithville	OH 44677	330-669-2801	buzz@neobright.net	
Bishop, Dave	Turk Brothers Custom Meats	984 Township Rd. 975	Ashland	OH 44805	419-281-1935	cmbish2000@cs.com	
Blakemore, Dave	Phillips Petroleum Company	411 SW Keeler Ave.	Bartlesville	OK 74004	918-661-6385	jdblake@ppco.com	Natural Resources
Brase, Terry	Kirkwood Community College	6301 Kirkwood Blvd, SW	Cedar Rapids	IA 52404	319-398-5458	tbrase@kirkwood.cc.ia.us	Power Structural & Technical Systems
Briggs, Scott	Tuscarawas SWCD	277 Canal Ave. SE	Philadelphia	OH 44663	330-339-7976	scott-briggs@oh.nacdnet.org	
Brock, Fred	Woodbridge H.S.	Karen Hutchison Delaware State Dept of Education PO Box 1402	Dover	DE 19903-1402		khutchison@state.de.us	Power, Structural & Technical Systems
Brown, Harold	Ohio State University Plant Pathology	3956 Grand Bend Dr.	Groveport	OH 43125	614-292-4913	brown.96@osu.edu	
Bruns, Gary	AgKnowledge	6301 Kirkwood Blvd	Cedar Rapids	IA 52406	319-398-5652	gbruns@kirkwood.cc.ia.us	All
Case, Larry	U.S. Dept. of Education, OVAE	330 C Street SW	Washington	DC 20202-7322	800-772-0939 703-838-5889	LCase@ffa.org	All
Chasen, Belinda	Florida Department of Education	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310			Env. Service Systems & Natural Resources

Name	Organization/ Company/School	Address	City	State, ZIP	Phone	E-mail	Pathway
Deimler, William	Utah State Office of Education	250 East 500 South P.O. Box 144200	Salt Lake City	UT 84111-4200	801-538-7856	wdeimler@usoe.k12.ut.us	Business Systems
Desmond, Steve	Oregon Department of Environmental Quality	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		Desmond.steven.m@deq.state.or.us	Environmental Service Systems
Donner, David	#1 Landscaping	PO Box 392	Hinckley	OH 44233	330-239-2882		
Duckworth, Rod	Office of Supt. Of Public Instruction	PO Box 47200	Olympia	WA 98504-7200	360-725-6244	rduckworth@ospi.wednet.edu	Food Products & Processing Systems
Elliot, Jack	University of Arizona	PO Box 210036, Forbes 224	Tucson	AZ 85721-0036	520-621-1523	elliot@ag.arizona.edu	All
Emely, Charles	American Society for Horticulture Science	600 Cameron St.	Alexandria	VA 22314			Plant Systems
Flory, Daniel	Curry Lumber	331 W Henry Street	Wooster	OH 44691	330-264-5223	currylumberdan@aol.com	
Fritzke, Dean	Tualatin Valley Water District	1850 SW 170th Ave PO Box 745	Beaverton	OR 97075		dean@tvwd.org	Natural Resources
Garey, Jerda	Department of Vocational Education	15 Wedgewood Dr.	McCook	NE 69001	308-345-5581	jgarey@mccooknet.com	All
Geiser, Randy	Maibach Tractor	13701 Eby Road	Creston	OH 44217	330-939-4192		
Gibson, James	Wisconsin Tech College System Board	PO Box 7874	Madison	WI 53707-7874	608-266-2412	Gibson@board.tec.wi.us	All
Griffith, Bill	Walla Walla Community College	500 Tausick Way	Walla Walla	WA 99362	509-527-4269	Bill.Griffith@wwcc.ctc.edu	All
Gruis, Dale	Iowa Dept. of Education	East 14th & Grand Avenue	Des Moines	IA 50319-0146	515-281-4712	dale.gruis@ed.state.ia.us	All
Harris, Coleman	U.S. Dept. of Education, OVAE	PO Box 83720	Washington	DC 20202-7322		charris@ffa.org	All
Harrison, Jim	Smyrna H.S.	Karen Hutchison Delaware State Dept of Education PO Box 1402	Dover	DE 19903-1402		khutchison@state.de.us	Power, Structural & Technical Systems
Haynes, Bill	Winchester Veterinary Clinic, Inc.	229 Winchester Cemetery Road	Winchester	OH 43110	614-837-5555	winchvetcl@aol.com	
Hoopes, Bill	The Scotts Company	14111 Scottslawn Rd.	Marysville	OH 43041			

Name	Organization/ Company/School	Address	City	State, ZIP	Phone	E-mail	Pathway
Hutchison, Karen	Delaware State Dept. of Education	PO Box 1402	Dover	DE 19903-1402	302-739-4681	khutchison@state.de.us	Power Structural & Technical Systems
Inkrott, Roger	Kaimbach Feeds, Inc.	2874 Morning Hill Drive	Wooster	OH 44691	330-465-8880	Inkr4ue@aol.com	
Johnston, Kelly	National Food Processors Association	1350 I Street NW, Suite 300	Washington	DC 20005-3305			Food Products & Processing Systems
Jordan, Mark	Westfield Group Country Club	PO Box 5001	Center	OH 44251	330-887-0832	markjordan@westfieldgrp.com	
Kemble, Jim	University of Delaware	Karen Hutchison Delaware State Dept of Education PO Box 1402	Dover	DE 19903-1402		khutchison@state.de.us	Power, Structural & Technical Systems
Kershaw, Isaac	Ohio Dept. of Education	25 South Front Street	Columbus	OH 43215-4183		Ike.Kershaw@ode.state.oh.us	Plant Systems
Knudsen, Doug	Fishbaugh Construction	Box 6, 48 S Kniffin St.	Greenwich	OH 44837	419-752-3694		
Lamers, Gerald R.	Department of Education State of Iowa	Grimes State Office Bldg.	Des Moines	IA 50319-0146	515-281-4712	Jerry.lamers@ed.state.ia.us	All
Lawler, Brad	Lawler Farms	6874 N State Road 3	Rushville	IN 46173			Animal Systems
Lawson, Currey	Sussex Central H.S.	Karen Hutchison Delaware State Dept of Education PO Box 1402	Dover	DE 19903-1402		khutchison@state.de.us	Power, Structural & Technical Systems
Lawson, John	Deere & Company	One John Deere Place	Moline	IL 60265-8098			Power Structural & Technical Systems
Lawson, Robert	Sussex Central H.S.	Karen Hutchison Delaware State Dept of Education PO Box 1402	Dover	DE 19903-1402		khutchison@state.de.us	Power, Structural & Technical Systems
Ledington, Richard	Idaho Division of Professional Tech Ed	PO Box 83720	Boise	ID 83720-0095	208-334-3216	dledingt@pte.state.id.us	All
Leising, James	Oklahoma State University	449 Ag Hall	Stillwater	OK 74074	405-744-5130	leising@okstate.edu	All

Name	Organization/ Company/School	Address	City	State, ZIP	Phone	E-mail	Pathway
Lokai, Larry	Ohio Seed Improvement Assoc.	793 Terry Lane	Urbana	OH 43078	937-653-6781	lokai.8@osu.edu	
Lundy, Tom	Christiana H.S.	Karen Hutchison Delaware State Dept of Education PO Box 1402	Dover	DE 19903-1402		khutchison@state.de.us	Power, Structural & Technical Systems
Maibach, Alph	W.G. Dairy Supply, Inc.	2224 Cleveland Rd.	Creston	OH 44217	330-435-6522		
Martin, Robert	Iowa State University	Ag Ed & Studies, 201 Curtiss	Ames	IA 50011	515-294-5904	drmartin@iastate.edu	All
McCarty, Suzanne	Cargill	PO Box 5650	Minneapolis	MN 55440-5650			Plant Systems
McKinney, Ted	Dow AgroSciences	9330 Zionsville Rd.	Indianapolis	IN 46268-1054			Plant Systems
McSweeney, Eileen	American Forest & Paper Association	One Champion Plaza, 13th Floor	Stamford	CT 06921			Natural Resources Systems
Meade, Darryl	DuPont Ag Products	Barley Mil Plaza, WM6-268	Wilmington	DE 19880-0038		Darryl.a.meade@usa.dupont.com	Plant Systems
Melodia, Anna	FFA Organization	PO Box 68960	Indianapolis	IN 46268-0960	317-802-4224	Amelodia@ffa.org	All
Moss, Jeffrey	University of Illinois	151 Bevier, 905 S Goodwin Ave	Urbana	IL 61801	217-390-8093	j-moss3@uiuc.edu	Animal Systems
Nicholson, Ed	Tyson Foods, Inc	PO Box 2020	Springdale	AR 72765-2020			Food Products & Processing Systems
Paterson, Marcia	Milton Hershey School	503 Meadow Lane P.O. Box 830	Hershey	PA 17033-0830	717520-2240	patersonm@mhs-pa.org	All
Peters, Rob	Stark County Park District	5300 Tyner St. NW	Canton	OH 44708	330-477-3609	Peters3@sssnet.com	
Phelan, Lauri	Iowa School to Work	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		Laurie.phelan@ed.state.ia.us	Natural Resources
Powell, Dick	Starker Forest Products	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		http://www.starkerforests.com	Natural Resources

Name	Organization/ Company/School	Address	City	State, ZIP	Phone	E-mail	Pathway
Powell, Edwin	Mount Victory Meats	670 E Marion St.	Mt. Victory	OH 43340	937-354-2326	mum@yahoo.com	
Powell, Ragina	Mount Victory Meats	670 E Marion St.	Mt. Victory	OH 43340	937-354-2326	mum@yahoo.com	
Purcell, Marsha	American Farm Bureau Federation	225 Touhy Ave	Park Ridge	IL 60068	847-685-8764	marshap@fb00.fb.org	All
Reisinger, Melissa	Animal Medical	1060 S. Court St.	Medina	OH 44256	330-722-5076	livluvlife@aol.com	
Rich, Bob	Montana Department of Natural Resources	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		borich@state.mt.us	Natural Resources
Rider, Rob	President, O.A. Newton and Sons	Karen Hutchison Delaware State Dept of Education PO Box 1402	Dover	DE 19903-1402		khutchison@state.de.us	Power, Structural & Technical Systems
Roig, Tom	T & B Landscapes	9705 Valley Rd.	Shreve	OH 44676	330-567-3580	tbroig@cs.com	
Ross, Brad	Ohio Dept. Natural Resources	Building B-3	Columbus	OH 43224	614-265-6616	brad.ross@dnr.state.oh.us	
Shumaker, Curtis	Okla. Dept. of Career and Technology Ed	1500 W 7th Avenue	Stillwater	OK 74074	405-743-5198	cshum@careerclusters.org	Cluster Coordinator
Sligar, Don	Oregon Dept. of Education	255 Capitol, NE	Salem	OR 97310	503-378-3600 ext 2252	Don.sligar@state.or.us	Natural Resources Systems
Smick-Attisana, Regina	University of New Hampshire	147 Cole Hall	Durham	NH 03824-3599			All
Smith, Eddie	Okla. Dept. of Career and Technology Ed	1500 W 7th Avenue	Stillwater	OK 74074	405-743-5495	ESMIT@okcareertech.org	All
Smith, Greg	USDA, CSREES	William Deimler Utah State Office of Education 250 East 500 south PO Box 144200	Salt Lake City	UT 84111-4200		Wdeimler@usoe.k12.ut.us	Agribusiness Systems

Name	Organization/ Company/School	Address	City	State, ZIP	Phone	E-mail	Pathway
Staller, Bernie	National FFA Organization	PO Box 68960	Indianapolis	IN 46268-0960	317-802-4268	bstaller@ffa.org	All
Stoller, Tom	TMS Stoller Tractor	8310 Blough Road	Sterling	OH 44276	330-669-3676	tmsstoller@bright.net	
Studeny, Robert	Ashland Florist	271 S Countryside Dr.	Ashland	OH 44805	419-289-3707	dotstudeny@aol.com	
Swan, Michael	Washington State University	William Deimler Utah State Office of Education 250 East 500 south PO Box 144200	Salt Lake City	UT 84111-4200		Wdeimler@usoe.k12.ut.us	Agribusiness Systems
Thompson, Ron	Farmland Industries, Inc.	12200 N Ambassador Dr.	Kansas City	MO 64163			Power Structural & Technical Systems
Thull, Gary	Pioneer Hi-Bred International, Inc.	7000 NW 62nd Aenue	Johnston	IA 50131-1000	515-270-3364	gary.thull@pioneer.com	Plant Systems
Tucker, John	Tucker Packing Co.	955 N Mill	Orrville	OH 44667	330-855-7991		
Waidelich, Will	Curriculum Materials Service	2120 Fyffe Road	Columbus	OH 43210-1067	614-292-2817	director@ohcms.org	All
Wenger, Melvin	Orrville Veterinary Clinic	1665 N Main St.	Orrville	OH 44667	330-682-2971	Melvet5@aol.com	
Wertz, Terry	Sabin Center / former State Forestry	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		wertzt@attbi.com	Natural Resources
Williams, David	USDA Fish and Wildlife Service – Portland	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310			Natural Resources
Wilson, David	Uintah High School	William Deimler Utah State Office of Education 250 East 500 south PO Box 144200	Salt Lake City	UT 84111-4200		Wdeimler@usoe.k12.ut.us	Agribusiness Systems
Wood, Duane	Wayne SWCD	428 W. Liberty St.	Wooster	OH 44691	330-262-2836	swcd@bright.net	
Wood, Michele	Holmes SWCD	62 W Clinton St.	Millersburg	OH 44654	330-674-2811	michelle-wood@oh.nacdnet.org	
Woodard, James	Georgia State Dept. of Education	1758 Twin Towers East	Atlanta	GA 30334	404-657-8311	jwoodard@doe.k12.ga.us	All

Name	Organization/ Company/School	Address	City	State, ZIP	Phone	E-mail	Pathway
Woods, Mike	King Career Center	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		Woods_Mike@xmail.asd.k12.ak.us	Natural Resources
Young, Brenda	Mid-Wood, Inc.	4571 Mayflower Rd	Fostoria	OH 44830	419-435-1660	customen@wcnet.org	

Organizations

California Agricultural Education Association	California Natural Resources/ Forestry	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		http://www.calaged.org/ResourceFiles/Curriculum/	Natural Resources
Connecticut State Department of Education	Connecticut State Department of Education	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		Ann.gaulin@po.state.ct.us www.state.ct.us/sde/	Natural Resources
Delaware Department of Education	Delaware AgriScience Curriculum Framework Volume One	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		http://www.doe.state.de.us/standards/agriscience/	Natural Resources
Florida State Department of Education	Florida State Department of Education	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		cordiln@mail.doe.state.fl.us	Natural Resources
Kansas Competency Based Curriculum Center – Washburn University	Washburn University	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		zzclay@pro.wuacc.edu 785.231.1010 x1534	Environmental Service Systems
Northwest Center for Sustainable Resources		Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		http://www.ncsr.org	Natural Resources
Ohio State University	Integrated Technical & Academic Competencies Environmental & Agricultural Career Cluster	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		http://www.cete.org/products/main/pdfdocs/itac-env.html	Natural Resources & Environmental Service Systems

Oklahoma Department of Career and Technology Education		1500 W 7th Ave	Stillwater	OK 74075		KSADL@okcareertech.org	Natural Resources
Oregon Department of Education – Office of Professional Technical Education	Oregon NRS Curriculum Frameworks – 1995	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		Don.sligar@state.or.us	Environmental Service Systems & Natural Resources
Oregon VOS		800 N.E. Oregon St.	Portland	OR 97232-2162		programs@oregonvos.net	Environmental Service Systems
Texas Skill Standards Board	Hazardous Materials Management Technician Standards Project	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		lrector@governor.state.tx.us www.tssb.org	Environmental Service Systems
Washington State Board for Community And Technical Colleges	Washington State Board for Community And Technical Colleges	Don Sligar Oregon Dept. Of Education 255 Capitol, NE	Salem	OR 97310		shanson@SBCTC.cte.edu	Environmental Service Systems & Natural Resources

Section VI – Credentials

Deliverable #2: Agriculture, Food and Natural Resources sample list of existing credentials
(Includes licenses, education and industry certificates, as well as postsecondary degree options)
Updated: August 24, 2002

Education and Industry *Licenses*

Title/Type/Descriptor of Licensing Program	Licensing Organization	Source for Contact Information
Agriculture Engineer	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Animal Control Officer	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Animal Scientist	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Dog Groomer	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Environmental Engineer	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Fire Protection Engineer	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Geologist	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Laboratory Animal Technicians	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Mining & Mineral Engineer	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Pet Care Technician	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Petroleum Engineer	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Private Pesticide Applicator	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Soil Scientist	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/
Veterinarian	States, Commonwealths, and Territories, Government Agencies	http://www.careertools.org/certification/

Education and Industry *Certificates*

Title/Type/Descriptor of Certification Program	Issuing Organization	Source for Contact Information
Accredited Agricultural Consultant	American Society of Farm Managers and Rural Appraisers	www.agri-associations.org/asfrma
Accredited Farm Manager	American Society of Farm Managers and Rural Appraisers	www.agri-associations.org/asfrma
Accredited Rural Appraiser	American Society of Farm Managers and Rural Appraisers	www.agri-associations.org/asfrma

Animal Control Officer	New Jersey Department of Health	New Jersey Department of Health and Senior Services Biological Services Program CN 364 Trenton, NJ 08625-0364 (609) 588-3121
Asbestos Hazard Abatement Air Monitoring Technician	OSHA through state jurisdictions	http://www.osha.gov/
Asbestos Hazard Abatement Specialist	OSHA through state jurisdictions	http://www.osha.gov/
Asbestos Hazard Abatement Worker	OSHA through state jurisdictions	http://www.osha.gov/
Asbestos Hazard Evaluation Specialist	OSHA through state jurisdictions	http://www.osha.gov/
Asbestos Hazard Project Designer	OSHA through state jurisdictions	http://www.osha.gov/
Assistant Laboratory Animal Technician	American Association for Laboratory Animal Science	American Association for Laboratory Animal Science 70 Timber Creek Drive, Suite 5 Cordova, TN 38018 (901) 754-8620
Associate Environmental Trainer	National Environmental Training Association 5320 North 16th St., Suite 114, Phoenix, AZ 85016	http://www.ehs-training.org/
Backflow Prevention Assembly Tester	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Basic Wild and Firefighter Training	U.S. Forest Service	
Biological Industrial Wastewater	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Board Certified Entomologist	Entomological Society of America 9301 Annapolis Road, Suite 300 Lanham, MD 20706	www.entsoc.org/
Certified Agricultural Irrigation Specialist	Irrigation Association 8260 Willow Oaks Corporate Drive, Suite 120, Fairfax, VA 22031	www.irrigation.org

Certified Arborist, Tree Worker, Utility Arborist	International Society of Arboriculture PO Box 3129 Champaign, IL 61826-3129 Phone (217) 355-9411 E-mail isa@isa-arbor.com	
Certified Crop Advisor	American Society of Agronomy	http://www.agronomy.org/cca/
Certified Drafter	American Design Drafting Association	http://www.adda.org
Certified Ecologist	Ecology Society of America 1707 H Street NW Washington, D. C. 20006	www.sdsc.edu/
Certified Environmental Health Technician	National Environmental Health Association	http://www.neha.org
Certified Environmental Trainer - Management & Transportation of Hazardous Materials & Waste	National Environmental Training Association 5320 North 16th St., Suite 114, Phoenix, AZ 85016	www.ehs-training.org
Certified Environmental Trainer - Radiation Protection	National Environmental Training Association 5320 North 16th St., Suite 114, Phoenix, AZ 85016	www.ehs-training.org
Certified Environmental Trainer - Wastewater Collection and Treatment	National Environmental Training Association 5320 North 16th St., Suite 114, Phoenix, AZ 85016	www.ehs-training.org
Certified Environmental Trainer - Water Treatment and Distribution	National Environmental Training Association 5320 North 16th St., Suite 114, Phoenix, AZ 85016	www.ehs-training.org
Certified Fish and Game Warden	California Department of Fish and Game-Enforcement Branch	http://www.dfg.ca.gov/enforcement/wardenacad.html
Certified Forester	Society of American Foresters	www.safnet.org
Certified Forester Program	Society of American Foresters 5400 Grosvernor Lane Bethesda, MD 20814-2198	http://www.safnet.org/index.shtml

Certified Hazardous Materials Executive	World Safety Organization 305 E. Market Street, PO Box 518, Warrensburg, MO 64093	http://www.worldsafety.org/
Certified Hazardous Materials Supervisor	World Safety Organization 305 E. Market Street, PO Box 518, Warrensburg, MO 64093	http://www.worldsafety.org/
Certified Hazardous Materials Technician I	World Safety Organization 305 E. Market Street, PO Box 518, Warrensburg, MO 64093	http://www.worldsafety.org/
Certified Hazardous Materials Technician II	World Safety Organization 305 E. Market Street, PO Box 518, Warrensburg, MO 64093	http://www.worldsafety.org/
Certified Irrigation Contractor	The Irrigation Association 6540 Arlington Blvd\ Falls Church, VA 20042	www.irrigation.org
Certified Irrigation Designer	The Irrigation Association 6540 Arlington Blvd\ Falls Church, VA 20042	www.irrigation.org
Certified Landscape Technician (CLT)	Associated Landscape Contractors of America (ALCA) 150 Elden Street, Suite 270 Herndon, VA 20170 Phone (703) 736-9666 (800) 395-ALCA	http://www.alca.org/
Certified Mapping Scientist, Remote Sensing (ASPRS)	American Society for Photogrammetry and Remote Sensing - Imaging & Geospatial Information Society	www.asprs.org
Certified Nutritionist	Clinical Nutrition Certification Board	http://www.cncb.org/default.htm
Certified Professional Crop Scientist/Specialists	ARCPACS 677 S. Segoe Road Madison, WI 53711	www.agronomy.org
Certified Professional in Erosion and Sediment Control	Soil and Water Conservation Society 7515 NE Ankeny Road, Ankeny, IA 50021	http://www.swcs.org/
Certified Professional in Rangeland Management	Society for Range Management	http://www.rangelands.org/ScriptContent/index.cfm
Certified Professional in Weed Science	ARCPACS 677 S. Segoe Road Madison, WI 53711	www.agronomy.org

Certified Professional Oregon Logger	The Yankee Group 23526 Lewis Dr. Philomath, OR 97370	http://www.theyankeegroup.com/oregon_professional_loggers.htm
Certified Professional Crop Plant Pathologist	ARCPACS 677 S. Segoe Road Madison, WI 53711	www.agronomy.org
Certified Professional Soil Classifier	ARCPACS 677 S. Segoe Road Madison, WI 53711	www.agronomy.org
Certified Range Management Consultant	Society for Range Management	http://www.rangelands.org/ScriptContent/index.cfm
Certified Safety Professional	Board of Certified Safety Professionals	http://www.bcsp.com
Certified Teacher (Science, Agriculture)	Specific State Board of Education	
Certified Waste Manager	Specific County Cooperative Extension Service	
Certified Welding Machine Operator	American Welding Society	http://www.waco.tstc.edu/cat2001/html/ip/76.html
Collection	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Commercial Drivers License	Oregon Department of Transportation 1905 Lana Avenue NE Salem, OR 97314	http://www.odot.state.or.us
Conservation Officer	Natural Resources Conservation Service	http://www.nrcs.usda.gov/
CPR Card	American Red Cross	http://www.redcross.org/
Cross-Connection	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Diplomat in Veterinary Microbiology: Bacteriology and Mycology	American College of Veterinary Microbiologists Department of Comparative Medicine, PO Box 1071, University of Tennessee, Knoxville, TN 37901-1071	http://www.vetmed.auburn.edu/acvm/

Diplomat in Veterinary Microbiology: Immunology	American College of Veterinary Microbiologists Department of Comparative Medicine, PO Box 1071, University of Tennessee, Knoxville, TN 37901-1071	http://www.vetmed.auburn.edu/acvm/
Diplomat in Veterinary Microbiology: Virology	American College of Veterinary Microbiologists Department of Comparative Medicine, PO Box 1071, University of Tennessee, Knoxville, TN 37901-1071	http://www.vetmed.auburn.edu/acvm/
Dog Groomer	National Dog Groomers Association of	National Dog Groomers Association of America P.O. Box 101 Clark, PA 16113 (724) 962-2711
Earth Driller	National Groundwater Association	http://www.groundwatersystems.com/dicat.html
Environmental Professional Intern Certification	National Environmental Health Association	http://www.neha.org
EPA Operators Certification Guidelines	Environmental Protection Agency	www.epa.gov/safewater
First Aid Card	American Red Cross	http://www.redcross.org/
Floral Designers	American Institute of Floral Design	http://www.tapestryflowers.com/aifd.html
Guidelines for the Certification and Recertification of the Operators of Community and Nontransient Noncommunity Public Water Systems	Environmental Protection Agency	www.epa.gov/safewater
Guidelines for the Certification and Recertification of the Operators of Community and Nontransient Noncommunity Public Water Systems	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Inspectors	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/

Laboratory Animal Technician	American Association for Laboratory Animal Science	American Association for Laboratory Animal Science 70 Timber Creek Drive, Suite 5 Cordova, TN 38018 (901) 754-8620
Laboratory Animal Technologist	American Association for Laboratory Animal Science	American Association for Laboratory Animal Science 70 Timber Creek Drive, Suite 5 Cordova, TN 38018 (901) 754-8620
Land Application/Biosolids	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Maintenance	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Mining Machine Operator	Bureau of Deep Mining Safety	http://www.dep.state.pa.us/dep/deputate/minres/dms/website/certification/certify.html
Monitor Well Constructors	Oregon Water Resources Department 1528 12th Street NE Salem, OR 97310	http://wrd.state.or.us
National Occupational Skill Standards: CADD (Computer Aided Drafting and Design	National Coalition for Advanced Manufacturing	http://www.acs.org/eduation/currmats/skils.html
National Voluntary Skills Standard: Hazardous Materials Management Technology	Center for Occupational Research and Development	http://cord.org/ncatc/hazmat.htm
Occupational Safety and Health Standards Confined Space Entry	Occupational Safety and Health Administration	http://www.osha.gov
Outfitters/Guides	Oregon State Marine Board 435 Commercial Street NE PO Box 14145 Salem, OR	http://www.boatoregon.com
Pesticide Applicators, Commercial, Private and Public	US Environmental Protection Agency	http://www.epa.gov/oppfead1/safety/applicators/applicators.htm

Pet Care Technician	American Boarding Kennel Association	American Boarding Kennel Association 4575 Galley Road, Suite 400-A Colorado Springs, CO 80915 (719) 591-1113 www.abka.com
Physical/Chemical Industrial Waste	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Pilots, River or Bar	Oregon Board of Maritime Pilots 800 NE Oregon St, #15 Portland, OR 97232	http://www.state.or.us/agencies.ns/73000/00040/
Power Saw Operation S212	USDA Forest Service	http://www.fs.fed.us/
Provisional Park & Recreation Professional	National Recreation and Park Association 22377 Belmont Ridge road, Ashburn, VA 20148	www.nrpa.org
Professional Wetland Scientist	Society of Wetland Scientists Certification Program, PO Box 1897, Lawrence, KS 66044-8897	http://www.wetlandcert.org/
Pump Installation Contractors, Limited	Oregon Department of consumer & Business Services 1535 Edgewater St NW Po Box 14470 Salem, OR 97309	http://www.oregonbcd.org
Real Property Review Appraiser	American Society of Farm Managers and Rural Appraisers	www.agri-associations.org/asfrma
Red Card – Firefighter	United State Forest Service	http://www.fs.fed.us/
Registered Environmental Health Specialist Certification	National Environmental Health Association 720 South Colorado Blvd., South Tower 970, Denver, CO 80246-1925	http://www.neha.org
Registered Environmental Manager	National Registry of Environmental Professionals P.O. Box 2099 Glenview, IL 60025	http://www.neha.org

Registered Environmental Scientists	National Registry of Environmental Professionals P.O. Box 2099 Glenview, IL 60025	http://www.neha.org
Registered Environmental Technician Certification	National Environmental Health Association 720 South Colorado Blvd., South Tower 970, Denver, CO 80246-1925	http://www.neha.org
Registered Hazardous Substance Specialist Certification	National Environmental Health Association 720 South Colorado Blvd., South Tower 970, Denver, CO 80246-1925	http://www.neha.org
Registered Laboratory Technician Certification	American Association of Bio-analysts	http://www.aaab.org
Sanitarian, Registered Certification	National Environmental Health Association	http://www.neha.org
Sanitarian, Trainees	Oregon Sanitarians registration Board, Health Licensing Office 700 Summer Street NE, Suite 320 Salem, OR 97310	http://hio.info.state.or.us
Small Wastewater System	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Solid Waste	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Survey Technician Certification	National Society of Professional Surveyors	http://www.survmap.org
Tank Tightness Testing Supervisor	Oregon Department of Environmental Quality 811 SW 6th Ave Portland, OR 97204	http://www.deq.state.or.us/wmc/tank/ust-lust.htm
Tractor-Trailer Driver Certification, Entry Level	Professional Truck Driver Institute	http://ptdi.org
Tractor-Trailer Drivers, Skill Standards for Entry Level	Professional Truck Driver Institute	http://www.ptdi.org/standards/

Urban and Community Forestry Certificate Program	Community Forestry Resource Center	http://www.forestrycenter.org/
Very Small Water System	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Wastewater Laboratory Analyst	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Wastewater System	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Wastewater Treatment	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Water Distribution	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Water Laboratory Analyst	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/
Water Rights Examiners, Certified	Oregon State Board of Examiners for Engineers & Land Surveyors 728 Hawthorne Ave NE Salem, OR 97310	http://www.osbeels.org
Water Treatment	Association of Boards of Certification 208 Fifth Street, Ames, Iowa 50010-6259 Phone (515) 232-3623 E-mail abc@abccert.org	http://www.abccert.org/

Water Well Constructors	Oregon Water Resources Department 1528 12th Street NE Salem, OR 97310	http://wrd.state.or.us
Wetland Professional in Training	Society of Wetland Scientists Certification Program, PO Box 1897, Lawrence, KS 66044-8897	http://www.wetlandcert.org/
Wilderness/Remote Location First Aid	National Safety Council 1121 Spring Lake Drive, Itasca, IL 60143	www.nsc.org
Wildfire Task Book Certification	National Wildfire Coordination Group	http://www.nwcg.gov/nwcg/index.htm http://www.nationalfiretraining.net/

Postsecondary *Degree Options*

Title/Type/Descriptor of Degree Program	Degree Conferring Organization	Source for Contact Information
Agricultural Animal Breeding and Genetics	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Animal Health	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Animal Husbandry and Production Management	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Animal Nutrition	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Animal Physiology	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural & Food Products Processing	Colleges and Universities	Classification of Instructional Programs Manual 01.0401
Agricultural Business & Management, General	Colleges and Universities	Classification of Instructional Programs Manual 01.0101
Agricultural Business & Production	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Economics	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Extension	Colleges and Universities	Classification of Instructional Programs Manual

Agricultural Mechanization, General	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Plant Pathology	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Plant Physiology	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Power Machinery Operator	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Production Workers & Managers, General	Colleges and Universities	Classification of Instructional Programs Manual
Agricultural Supplies Retailing & Wholesaling	Colleges and Universities	Classification of Instructional Programs Manual
Agriculture/Agricultural Sciences, General	Colleges and Universities	Classification of Instructional Programs Manual
Agronomy & Crop Science	Colleges and Universities	Classification of Instructional Programs Manual
Animal Control Officer	Public & Private Technical Schools	Classification of Instructional Programs Manual
Animal Sciences, General	Colleges and Universities	Classification of Instructional Programs Manual
Animal Trainer	Colleges, Universities and Technical Schools	Classification of Instructional Programs Manual
Aquaculture Operations and Production Management	Colleges and Universities	Classification of Instructional Programs Manual
Assistant Laboratory Animal Technician	Colleges, Universities and Technical Schools	Classification of Instructional Programs Manual
Crop Production Operations and Management	Colleges and Universities	Classification of Instructional Programs Manual
Dairy Science	Colleges and Universities	Classification of Instructional Programs Manual
Dog Groomer	Public & Private Technical Schools	Classification of Instructional Programs Manual
Environmental Science/Studies	Colleges and Universities	Classification of Instructional Programs Manual
Equestrian/Equine Studies, Horse Management and Training	Colleges and Universities	Classification of Instructional Programs Manual
Farm & Ranch Management	Colleges, Universities and Technical Schools	Classification of Instructional Programs Manual
Fishing and Fisheries Sciences and Management	Colleges and Universities	Classification of Instructional Programs Manual
Food Sciences & Technology	Colleges and Universities	Classification of Instructional Programs Manual
Forest Harvesting and Production Technology/Technician	Colleges and Universities	Classification of Instructional Programs Manual
Forest Management	Colleges and Universities	Classification of Instructional Programs Manual
Forest Production and Processing	Colleges and Universities	Classification of Instructional Programs Manual
Forestry and Related Sciences, Other	Colleges and Universities	Classification of Instructional Programs Manual
Forestry, General	Colleges and Universities	Classification of Instructional Programs Manual
Forestry, Sciences	Colleges and Universities	Classification of Instructional Programs Manual
Greenhouse Operations and Management	Colleges and Universities	Classification of Instructional Programs Manual
Horticulture Science	Colleges and Universities	Classification of Instructional Programs Manual

Horticulture Services Operations & Management	Colleges and Universities	Classification of Instructional Programs Manual
International Agriculture	Colleges and Universities	Classification of Instructional Programs Manual
Laboratory Animal Technician	Public & Private Technical Schools	Classification of Instructional Programs Manual
Laboratory Animal Technologist	Public & Private Technical Schools	Classification of Instructional Programs Manual
Landscaping Operations and Management	Colleges and Universities	Classification of Instructional Programs Manual
Logging/Timber Harvesting	Colleges and Universities	Classification of Instructional Programs Manual
Natural Resources Conservation	Colleges and Universities	Classification of Instructional Programs Manual
Natural Resources Management and Protective Services	Colleges and Universities	Classification of Instructional Programs Manual
Nursery Operations and Management	Colleges and Universities	Classification of Instructional Programs Manual
Ornamental Horticulture Operations and Management	Colleges and Universities	Classification of Instructional Programs Manual
Pet Care Technician	Public & Private Technical Schools	Classification of Instructional Programs Manual
Plant Breeding and Genetics	Colleges and Universities	Classification of Instructional Programs Manual
Plant Protection (Pest Management)	Colleges and Universities	Classification of Instructional Programs Manual
Plant Sciences, General	Colleges and Universities	Classification of Instructional Programs Manual
Poultry Science	Colleges and Universities	Classification of Instructional Programs Manual
Private Pesticide Applicator	Public & Private Technical Schools	Classification of Instructional Programs Manual
Range Science and Management	Colleges and Universities	Classification of Instructional Programs Manual
Soil Sciences	Colleges and Universities	Classification of Instructional Programs Manual
Turf Management	Colleges and Universities	Classification of Instructional Programs Manual
Wildlife and Wildlands Management	Colleges and Universities	Classification of Instructional Programs Manual
Wood Science and Pulp/Paper Technology	Colleges and Universities	Classification of Instructional Programs Manual

Section VII – Validation Overview/ Results

VALIDATION REPORT

Background

Cluster advisory committees made up of business and industry representatives, secondary/postsecondary educators, associations/organizations, government agencies and other stakeholders developed and conducted an initial review of the knowledge and skills statements. From July 15, 2002 through August 15, 2002, the States' Career Clusters Initiative conducted a national online validation of the knowledge and skill statements. The validation rated the degree of commonality and importance of each statement (see tables below). Each Cluster Committee reviewed the knowledge and skill ratings as well as any written responses to a particular statement. Likewise, each committee determined the appropriate action to take with regard to this data.

Cluster Question:

Question #1 : Is the knowledge and skill statement common to all occupations across the cluster ?	Question #2 : Is the knowledge and skill statement important to workplace success and/or further education ?

Pathway Question:

Question #1 : Is the knowledge and skill statement common to all occupations across the pathway ?	Question #2 : Is the knowledge and skill statement important to workplace success and/or further education ?

Rating Key:

Question #1:	Question #2:
☐ Don't Know -N/A	☐ Don't Know -N/A
☐ Common to a few (25% or less)	☐ Not important
☐ Common to some (25 - 50%)	☐ Somewhat important
☐ Common to many (51 - 75%)	☐ Important
☐ Common to most (76 - 100%)	☐ Critical

General Validation Statistics for the Eleven Clusters

Total Number of Respondents: 1133 completed profiles, 828 completed validation
Number of States/Others Represented: All 50 states/5 other
Overall profiles of respondents:

- Organization Type
  - Business/Industry –17.3 %
  - State Agency – 13.4 %
  - Federal Agency – 2.4 %
  - Association – 6.2 %
  - Secondary Education – 36.5 %
  - Postsecondary Education – 14.1 %
  - Other – 10.1 %
- Average # of Years of Experience: 18.3 years

Agriculture, Food, and Natural Resources Cluster Validation Statistics

Total Number of Respondents: 187
Number of States/Others Represented: 37
Overall profiles of respondents:

- Organization Type
  - Business/Industry – 9.6 %
  - State Agency – 8.0 %
  - Federal Agency – .5 %
  - Association – 5.3 %
  - Secondary Education – 58.3 %
  - Postsecondary Education – 17.1 %
  - Other –1.2 %
- Average # of Years of Experience: 16 years

Cluster Responses

Ratings of "Don't Know" are not included in this report.

StatementCode	StatementDescription	# Rsps	Q1 Avg	Q1=1	Q1=2	Q1=3	Q1=4	Q2 Avg	Q2=1	Q2=2	Q2=3	Q2=4
			Question #1: Is the knowledge and skill statement common to all occupations across the cluster?					Question #2: Is the knowledge and skill statement important to workplace success and/or further education?				
Cluster: Agriculture, Food and Natural Resources												
AGC01.01	Achieve AFNR specific academic knowledge and skills required to pursue the full range of career and post-secondary education opportunities within AFNR.	163	3.39	6	14	54	89	3.31	0	15	82	66
AGC02.01	Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.	171	3.75	1	5	30	135	3.65	0	3	53	115
AGC02.02	Employ technical communications effectively to maintain good records and reporting procedures.	171	3.48	0	17	55	99	3.47	0	7	76	88
AGC03.01	Solve problems using critical thinking skills (e.g., analyze, synthesize and evaluate) independently and in teams.	168	3.66	2	5	41	120	3.65	0	4	50	114
AGC03.02	Access suitable resources to identify public policies, issues and regulations impacting AFNR management.	165	2.96	10	37	68	50	2.98	0	42	85	38
AGC04.01	Use information technology tools specific to AFNR to access, manage, integrate and create information.	168	3.38	3	15	66	84	3.32	0	13	89	66
AGC05.01	Understand roles within teams, work units, departments, organizations, interorganizational systems, and the larger environment.	169	3.41	4	15	58	92	3.36	0	19	71	79
AGC05.02	Identify how key organizational systems affect organizational performance and the quality of products and services.	165	3.04	9	35	61	60	2.95	2	47	74	42
AGC06.01	Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.	168	3.40	4	22	45	97	3.34	0	22	67	79
AGC06.02	Identify health goals and safety procedures for natural resource occupations.	165	3.21	8	25	57	75	3.27	0	26	68	71

StatementCode	StatementDescription	# Rsps	Q1 Avg	Q1=1	Q1=2	Q1=3	Q1=4	Q2 Avg	Q2=1	Q2=2	Q2=3	Q2=4
AGC06.03	Demonstrate appropriate health and safety procedures for environmental service occupations.	164	3.26	7	28	44	85	3.35	1	22	59	82
AGC07.01	Use premier leadership skills in collaborating with others to accomplish organizational goals and objectives.	166	3.57	4	7	46	109	3.57	0	5	61	100
AGC07.02	Use personal growth skills in collaborating with others to accomplish organizational goals and objectives.	166	3.57	6	7	40	113	3.49	1	10	61	94
AGC08.01	Know and understand the importance of professional ethics and legal responsibilities.	167	3.53	5	8	48	106	3.55	0	8	59	100
AGC08.02	Demonstrate workplace ethics specific to natural resource occupations.	163	3.44	4	14	52	93	3.51	0	7	66	90
AGC09.01	Know and understand the importance of employability skills.	165	3.78	2	2	27	134	3.71	0	6	36	123
AGC09.02	Explore, plan and effectively manage careers.	163	3.47	2	16	48	97	3.34	0	21	65	77
AGC10.01	Use the technical knowledge and skills required to pursue the full range of careers for all AFNR pathways, including knowledge of design, operation, and maintenance of technological systems critical to AFNR careers.	159	3.18	6	30	52	71	3.11	0	40	61	58
AGC10.02	Use hand tools, equipment, machinery and technology to work in areas related to AFNR.	164	3.30	5	18	64	77	3.26	1	20	79	64
AGC10.03	Compare and contrast issues affecting the AFNR industry (e.g., Genetically Modified Organizations (GMO), biotechnology, employment, safety, environmental, genetic engineering, animal welfare).	163	3.12	7	32	58	66	3.21	0	25	78	60
AGC10.04	Envision emerging technology/globalization to project its influence on widespread markets.	161	2.99	10	41	51	59	3.14	2	29	74	56
	Totals:	**3474**	**3.37**	**105**	**393**	**1065**	**1911**	**3.36**	**7**	**391**	**1414**	**1662**

Pathway Response

Ratings of "Don't Know" are not included in this report.

StatementCode	StatementDescription	# Rsps	Q1 Avg	Q1=1	Q1=2	Q1=3	Q1=4	Q2 Avg	Q2=1	Q2=2	Q2=3	Q2=4
		Question #1: Is the knowledge and skill statement common to all occupations within the pathway?						Question #2: Is the knowledge and skill statement important to workplace success and/or further education?				
Cluster: Agriculture, Food and Natural Resources		**Pathway: Food Products and Processing Systems**										
AGPA01.01	Apply principles of food processing to the food industry.	70	3.47	1	5	24	40	3.47	0	5	27	38
AGPA01.02	Apply principles of food science to the food industry.	70	3.46	2	4	24	40	3.47	0	4	29	37
AGPA01.03	Plan, implement, manage, and/or provide services for the preservation and packaging of food and food products.	70	3.13	3	12	28	27	3.27	1	6	36	27
AGPA01.04	Identify processing, handling, and storage factors to show how they impact product quality.	70	3.39	2	9	19	40	3.43	1	3	27	38
Cluster: Agriculture, Food and Natural Resources		**Pathway: Plant Systems**										
AGPB01.01	Apply principles of anatomy and physiology to produce and manage plants in both a domesticated and a natural environment.	95	3.53	2	4	31	58	3.39	0	2	46	45
AGPB01.02	Address taxonomic or other classifications to explain basic plant anatomy and physiology.	95	3.13	6	13	39	37	2.95	1	20	49	23
AGPB01.03	Apply fundamentals of production and harvesting to produce plants.	94	3.27	1	17	32	44	3.22	0	13	39	40
AGPB01.04	Exercise elements of design to enhance an environment (e.g., floral, forest, landscape, farm).	92	3.03	4	23	31	34	3.01	1	14	48	26
Cluster: Agriculture, Food and Natural Resources		**Pathway: Animal Systems**										
AGPC01.01	Apply knowledge of anatomy and physiology to produce and/or manage animals in a domesticated or natural environment.	94	3.54	1	9	22	62	3.43	0	2	46	45
AGPC01.02	Recognize animal behaviors to facilitate working with animals safely.	94	3.37	3	11	28	52	3.35	0	8	37	47
AGPC01.03	Provide proper nutrition to maintain animal performance.	94	3.36	3	11	29	51	3.46	0	5	33	54

StatementCode	StatementDescription	# Rsps	Q1 Avg	Q1=1	Q1=2	Q1=3	Q1=4	Q2 Avg	Q2=1	Q2=2	Q2=3	Q2=4
AGPC01.04	Know the factors that influence an animal's reproductive cycle to explain species response.	94	3.20	3	13	40	38	3.30	1	5	49	38
AGPC01.05	Identify environmental factors that affect an animal's performance.	94	3.41	3	10	26	55	3.39	0	6	41	46
Cluster:	**Agriculture, Food and Natural Resources**	**Pathway:**		**Power Structural & Technical Systems**								
AGPD01.01	Apply physical science principles to engineering applications with mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.	66	3.47	1	3	26	36	3.26	0	5	31	28
AGPD02.01	Apply principles of operation and maintenance to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.	66	3.52	1	4	21	40	3.42	0	3	28	34
AGPD02.02	Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.	66	3.41	1	7	22	36	3.27	1	4	33	27
AGPD03.01	Exercise basic skills in blueprint and design development to create sketches, drawings and plans.	65	2.88	5	14	30	16	2.95	0	16	32	16
AGPD03.02	Read and relate structural plans to specifications and building codes.	65	2.83	5	20	21	19	3.05	0	13	32	19
AGPD03.03	Examine structural requirements to estimate project costs.	66	2.85	8	15	22	21	3.03	0	15	30	20
AGPD03.04	Develop skills required to use construction/fabrication equipment and tools.	65	3.09	4	15	17	29	3.26	0	7	30	27
AGPD03.05	Plan, implement, manage, and/or provide support services to facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.	64	3.08	1	15	26	22	3.09	0	12	30	21
AGPD04.01	Use the variety of tools available in computer systems to accomplish fast, accurate production in the workplace.	65	3.18	2	10	27	26	3.15	0	10	31	23
AGPD04.02	Use available power sources to plan and apply control systems.	66	2.92	3	15	32	16	2.92	0	15	37	13

StatementCode	StatementDescription	# Rsps	Q1 Avg	Q1=1	Q1=2	Q1=3	Q1=4	Q2 Avg	Q2=1	Q2=2	Q2=3	Q2=4
AGPD04.03	Explain geospatial technology to demonstrate its applications.	65	2.52	11	19	25	10	2.69	2	22	31	9
Cluster: Agriculture, Food and Natural Resources		**Pathway: Natural Resources Systems**										
AGPE01.01	Recognize importance of resource and human interrelations to conduct management activities in natural habitats.	72	3.58	1	3	21	47	3.40	0	3	29	38
AGPE01.02	Use effective venues to communicate natural phenomena to the public.	72	3.18	3	10	30	29	3.04	0	10	37	22
AGPE01.03	Apply scientific principles to natural resource management activities.	72	3.49	2	3	25	42	3.44	0	2	28	40
AGPE01.04	Employ knowledge of natural resource industries to describe production practices and processing procedures.	71	3.35	3	4	29	35	3.21	0	6	36	27
AGPE01.05	Practice responsible conduct to protect natural resources.	72	3.74	0	3	13	56	3.60	0	2	17	51
Cluster: Agriculture, Food and Natural Resources		**Pathway: Environmental Service Systems**										
AGPF01.01	Use analysis procedures to plan and evaluate environmental service impacts.	58	3.07	3	10	25	20	3.05	0	6	35	15
AGPF01.02	Identify public policies and regulations impacting environmental services to determine their effect on facility operation.	57	3.12	2	9	26	20	3.18	0	4	31	20
AGPF01.03	Apply scientific principles to environmental services.	58	3.53	1	5	14	38	3.45	0	2	20	34
AGPF01.04	Operate environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy) to manage a facility environment.	59	2.83	7	13	22	17	2.95	0	11	32	14
AGPF01.05	Use hand tools, equipment, machinery and technology to accomplish tasks in environmental services.	58	3.24	1	12	17	28	3.10	1	9	23	23
Cluster: Agriculture, Food and Natural Resources		**Pathway: Agribusiness Systems**										
AGPG01.01	Employ leadership skills to accomplish goals and objectives in an AFNR business environment.	78	3.74	0	3	14	61	3.49	0	4	24	48

StatementCode	StatementDescription	# Rsps	Q1 Avg	Q1=1	Q1=2	Q1=3	Q1=4	Q2 Avg	Q2=1	Q2=2	Q2=3	Q2=4
AGPG01.02	Practice good record keeping to accomplish AFNR business objectives.	77	3.70	0	3	17	57	3.53	0	3	22	50
AGPG01.03	Apply generally accepted accounting principles and skills to manage budget, credit, and optimal application of AFNR business assets.	77	3.60	0	3	25	49	3.47	0	1	31	43
AGPG01.04	Employ AFNR industry concepts and practices to manage inventory.	77	3.21	3	10	32	32	3.09	1	11	37	26
AGPG01.05	Utilize technology to accomplish AFNR business objectives.	78	3.62	0	3	24	51	3.46	0	2	30	44
AGPG01.06	Use sales and marketing principles to accomplish an AFNR business objective.	78	3.46	0	6	30	42	3.27	0	3	39	33
	Totals:	**2959**	**3.29**	**102**	**378**	**1006**	**1473**	**3.25**	**10**	**294**	**1323**	**1269**

Section VIII – Assessment Protocol
Certification Protocol

Deliverable #7
Title: Protocol for Career Clusters Assessment
8/5/2002 4:00 PM

Definition of Career Clusters Assessment

Assessment, within the context of the Career Clusters Initiative, is defined as *a **measurement** of what a learner should know and be able to do*. The academic and technical knowledge and skills common to all occupations and pathways within a single cluster are initially addressed in the Career Clusters Initiative. Each cluster measures or assesses a learner's knowledge and skills related to the cluster.

Purpose of the Protocol for Career Clusters Assessments

The purpose of this document is to provide:

- Minimum criteria for selecting existing assessment instruments that align to the academic and technical knowledge and skills identified for each cluster.
- Minimum criteria for developing new assessment instruments that align to the academic and technical knowledge and skills identified for each cluster.
- Minimum criteria for validating and determining reliability of assessment instruments.

Functions of Career Clusters Assessment

Career Cluster Assessment serves to

- *measure* (assess) *student achievement*, both cognitive and performance, in areas of academic and technical knowledge and skills for each cluster
- *provide the basis* for a transportable, industry-endorsed certification.

Operational Guidelines for Career Clusters Assessment

This protocol includes minimum criteria/expectations career cluster designers need to apply in the selection/development of assessment modalities. Career clusters assessment:

CONTENT

- measures all 10 Foundation knowledge and skills.
- customizes context of questions and applications to individual clusters.
- reflects a high degree of specificity of measurable knowledge and skills.
- aligns to academic standards.
- connects to post high school standards and competencies.
- is consistent with Perkins data-quality criteria.

FORM

- combines a minimum of two modalities: cognitive and performance.
- includes an item bank that can accommodate multiple applications.
- reflects quality design and clear formats.

APPLICATIONS AND USES

- offers diagnostic feedback to the learner.
- provides added value to the user (employer, post high school); not required for employment.
- affords portability of results.
- provides cues for instruction.

ADMINISTRATION

- validates identity of test takers through a secure system.
- affords flexible administration, e.g. single assessment per foundation cluster topic or combination of topics.
- provides flexible timing for administration.
- affords no cost or low cost to students.
- includes an affordable, user-friendly process to cover administrative costs.
- reflects an administration process that is as consistent as possible with other career cluster assessments.
- includes an affordable, user-friendly maintenance process.

VALIDITY AND RELIABILITY

- uses consistent, reliable, and technically strong elements.
- is recognized by business and industry.
- is recognized by post high school education and training.

Deliverable #8
Title: Protocol for Career Clusters Certification
8/23/2002 2:28 PM

Definition of Career Clusters Certification

Certification, within the context of the States' Career Clusters Initiative, *documents* learner achievement of the academic and technical knowledge and skills common to all pathways and occupations within a cluster. It is based on valid and reliable assessments. A certificate is recognized by employers, secondary education, and post high school education as "value added to the admissions process to further education, immediate employment process, and/or to employment advancement".

Purposes of the Protocol for Careers Cluster Certification

The purposes of this document are to provide:

- Minimum criteria for selecting existing certification programs that align to the academic and technical knowledge and skills identified for each cluster.
- Minimum criteria for developing new certification programs that align to the academic and technical knowledge and skills identified for each cluster.
- Minimum criteria for determining the value of a certification program.

Functions of Career Clusters Certification

Career Cluster Certification serves to provide a consistent, transportable method of documenting learner achievement of a Career Cluster's validated academic and technical knowledge and skills. The system is based on valid and reliable assessments.

Operational Guidelines for Career Clusters Certification

This protocol includes minimum criteria/expectations career cluster designers need to apply in the selection/development of certification processes. Career clusters certification:

- Defines the purpose and scope of the certificate.
- Bases issue of the certificate on assessed learner proficiencies and competencies related to a Career Cluster's validated academic and technical knowledge and skills.
- Requires learner to meet the assessment benchmark identified.
- Informs the public concerning the knowledge and skills of the certificate holder.
- Indicates date of issue on the certificate.
- Issues certificate from the State (State Director of Career-Technical Education or appropriate designee) if the issuing organization is a secondary or post secondary education institution.
- Issues certificate from the CEO (or an appropriate designee) of an issuing professional organization/agency/institution/company.
- Requires issuing organization to maintain a database (state and/or national) of certificate holders based on the respective term of renewal.

National Association of State Directors
of Career Technical Education Consortium

www.careerclusters.org

Revised June 2003